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A REVIEW OF MAJOR DEVELOPMENTS IN THE WORLD COPPER MARKET AND INDUSTRY FROM 1980 TO 1992 AND FUTURE PROSPECTS

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Chapters			Paragraphs
Abbreviations			
Explanatory notes			
	Introduction and summary		1 - 7
I.	Demand		8 - 36
	A.	Changes in the geographical distribution of demand	8 - 14
	B.	Intensity of use	15 - 24
	C.	End-uses	25 - 33
	D.	Conclusion	34 - 36
II.	Supply		37 - 118
	A.	Industry structure	37 - 90
		1. The copper industry until the 1980s	40 - 43
		2. Changes in North America	44 - 53
		3. The leading firms and their strategies	54 - 56
		4. The internationalization of production	57 - 66
		5. Privatization	67 - 88
		6. Conclusion	89 - 90
	B.	Changes in the geographical distribution of production	91 - 118
		1. Mine production	91 - 101
		2. Unrefined production	102 - 106
		3. Refined production	107 - 118
III.	Technological and environmental issues		119 - 133
IV.	International trade		134 - 165
	A.	Copper ore	137 - 148
	B.	Unrefined copper	149 - 152
	C.	Refined copper	153 - 165
V.	Market balance, stocks and prices		166 - 173
	Annex		

List of charts

1. Intensity of use of copper, 1960-1991
2. Per capita copper consumption, 1960-1992
3. World refined copper consumption growth, 1950-1990
4. Change in copper cash production costs, 1981-1988
5. Copper reserves in 1991
6. Western mine copper production capacity by ore processing method, 1980-2000
7. Conventional and SX-EW copper production
8. United States net imports of unwrought copper, 1960-1992
9. Copper market balance, stocks and prices, 1970-1993
10. Nominal and real copper prices, 1960-1993

Abbreviations

c/lb	US dollar cents/pound
CDA	Copper Development Association Inc. (USA)
Cu	copper content
ECLAC	Economic Commission for Latin America and the Caribbean
GDP	gross domestic product
kt	thousand tons
ktpy	thousand tons per year
LME	London Metal Exchange
NMP	net material product
p.a.	per annum
SX-EW	solvent extraction-electrowinning
t	tons
tpy	tons per year
USBM	United States Bureau of Mines (Department of the Interior)

Explanatory notes

"Tons" refers to metric tons unless otherwise specified

"Western world" refers to the combination of developed market-economy countries with developing countries (i.e., total world excluding countries of Eastern Europe and socialist countries of Asia)

Statistics for Eastern Europe include East Germany until 1990, unless otherwise indicated. Thereafter, figures for the East German states are included in the total for Germany and, consequently, in the data for Western Europe

INTRODUCTION AND SUMMARY

1. Copper production and consumption increased at a considerably slower pace in the 1980s than during the previous decade. This slowdown is still more pronounced if compared to the growth rate of the 1960s. The weaker expansion was due basically to the slowdown in overall economic growth during that period. It was also caused by downsizing, miniaturization, and substitution by other metals and/or materials, which had begun to exert a depressing influence on the growth of copper consumption in industrialized countries in the 1960s, although during the last ten years some of these processes slowed down or were reversed in the case of some end-uses.

2. Intensity of use of copper continued to fall in the United States but stabilized or even increased marginally in Western Europe and Japan. However, the most important change in the geographical distribution of demand was the quick increase in consumption in the rapidly industrializing countries of South East and South Asia and in China. The continuation of economic growth in those countries and, to a lesser extent, in Latin America, together with the reversal of the decline in intensity of use in developed countries, represent a strong potential for future copper demand growth. Therefore, consumption in the coming years is projected to expand at a quicker pace than in the 1970s and 1980s. This has led producing companies to accelerate their investments in the expansion of existing facilities and the building of new plants.

3. At the beginning of the 1980s the world copper industry was mostly controlled by national interests (mainly state-owned companies in developing countries and private firms in industrialized countries). This situation started changing at the end of the decade and at the beginning of the 1990s. The change was due to the increasing internationalization of production (through the expansion abroad of companies from developed countries) and privatization of state-owned companies in developing countries. Though the latter process still faces many obstacles, its strengthening and eventual implementation in Eastern Europe are bound to shape the future structuring of the industry and the relative position of its major players. In the United States the copper industry underwent a major restructuring during the last decade. This led to an increase in the degree of concentration and had as one of its features the acceleration of the exit of petroleum companies from the copper industry.

4. In terms of the geographical distribution of production, Chile consolidated its leadership as by far the largest primary copper producer. At the same time, production declined in Zambia and especially Zaire, thus leading to a decrease in the respective market shares of these two countries. These two trends will probably continue in the near future. After the restructuring of its industry, the United States succeeded in increasing its mine production and regained the market share it had lost during the first part of the 1980s.

5. The most important technological changes undergone by copper production during the period surveyed were the rapid spread of solvent extraction-electrowinning (SX-EW) as an alternative to the conventional concentration-smelting-refining route and the increasing use of flash smelting and electrolytic refining (mostly in place of reverberatory smelting and fire refining, respectively). The adoption of these production methods resulted in higher recovery rates, lower emissions and reduced production costs. Consequently they often combined higher economic returns with improved environmental performance.

6. The unwrought copper trade, unlike production and consumption, continued to grow during the 1980s at a pace similar to that of the 1970s. Chile and the United States experienced a strong increase in their share of total world exports, whereas the African countries saw theirs reduced by half. Japan maintained its position as the largest unwrought copper importing country, accounting for more than one fifth of the world total. Taiwan, Province of China, and the Republic of Korea more than doubled their share in total world imports and became the fifth and sixth largest importers, respectively. In terms of products, the importance of trade in concentrates grew at the expense of trade in unrefined metal.

7. Copper prices reached a peak in 1980 and were then depressed during an unusually long period (from 1982 to 1986). Thereafter, they rose steeply until early 1989 because supply was slow to

react to the pick-up in demand. Subsequently, prices fell sharply, particularly in 1991 and 1993, due to the slowdown of demand and the continuing expansion of production. In real terms, however, prices pursued their downward trend during the 1980s. The hike of 1988-1990 was just sufficient to slow down the rate of decline of real prices for copper. However, the prospects for the copper market are positive. In the coming years, growth of copper demand is forecast to match the expansion of mine capacity or even to exceed it. This would require investments additional to those planned at present.

I. DEMAND

A. Changes in the geographical distribution of demand

8. World copper consumption[1] grew at an average rate of 1.3 per cent between 1980-1982 and 1990-1992, a considerably slower rhythm than that of the 1970s (2.3 per cent p.a.) and of the 1960s (4.1 per cent p.a.). This was due to the reduction in the pace of economic growth since 1980 (especially during the early 1980s and the early 1990s) as compared to the rate of expansion over the previous decades. Demand for copper reached the level of 10 million tons in 1986 and exceeded 11 million tons three years later, though it fell from 1990 to 1992. However, regional developments in copper demand took different directions over that period.

9. Copper consumption has traditionally been concentrated in industrialized countries, though their share in world demand contracted during the 1970s from 73.5 per cent to 65.5 per cent. In the 1980s, consumption in developed countries grew at approximately the same rate as the world total. Thus the group maintained its share in world demand (around 65 per cent) throughout the period. Three developed countries (United States, Japan and Germany), were the largest consumers in 1990-1992, accounting for 43.4 per cent of the world total (tables 1 and 2).[2]

10. The most important change in the geographical distribution of copper demand during the 1980s resulted from the rapid growth of consumption in developing Asian countries (13.8 per cent p.a. on average). Fuelled by the accelerated pace of industrial growth, demand in those countries (together with China) helped to sustain world copper demand at the beginning of the 1990s. This partly offset the fall in developed countries' copper consumption, caused by the cooling down of their economic growth. This highlights the importance those countries have acquired in the world copper market. The most important consuming countries in that region are Taiwan, Province of China, and the Republic of Korea. Their copper consumption increased at an annual rate of 16.4 per cent and 10.9 per cent, respectively, during the 1980s. Consequently they became the world's eighth and tenth largest refined copper consumers in 1990-1992, respectively (whereas in 1980-1982 they had occupied the 22nd and 17th positions).

11. Rapid growth of demand in developing Asia was not, however, restricted to those two countries during the last twelve years. Copper consumption increased also in Malaysia, the Islamic Republic of Iran, Thailand, Indonesia and Turkey at an annual rate higher than 11 per cent during this period. In India it grew by an annual rate of 6 per cent. As a result, the region's share in world consumption expanded from 3.7 per cent at the beginning of the 1980s to 11.8 per cent ten years later. A similar development took place in China, where the growth of copper consumption accelerated to 6.2 per cent p.a. after 1984, fuelled by the country's rapid industrial growth. This made China the world's fifth largest consumer in the early 1990s.

12. Whereas copper consumption grew at very fast rates in developing Asia, it experienced a drop in Latin America. This was mainly due to the fall in consumption in Brazil (the region's largest copper consumer) in the years 1981-1983 and 1988-1990. In Mexico (the second largest important consuming country of the region), demand underwent strong fluctuations during the period. In 1990-1992 it was just 11 per cent above its level ten years earlier. The share of this region in world consumption slightly decreased from 4.9 to 3.9 per cent.

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[1] The best measure of total copper consumption is that which comprises refined consumption and the direct use of scrap by manufacturers. However, data for the latter are not available for Eastern European countries or for the socialist countries of Asia. Therefore we use refined consumption data in assessing copper demand. The share of direct use of scrap in Western countries has remained stable over the last 30 years (25 to 30 per cent of total consumption). Therefore, metal consumption **trends** are adequately indicated by refined consumption data, though not its level.

[2] All tables are in the annex.

13. Although copper consumption in developing Africa grew during the 1960s and the 1970s at an average rate of 5.5 per cent p.a., in 1980-1982 the region still accounted for only 0.3 per cent of world demand. In the following decade, the consumption increase recorded in Zimbabwe and Zambia was offset by the fall of demand in other countries. Therefore, the region's share in world demand remained constant at 0.3 per cent. Since the decrease in the share of Latin America was more than compensated by the growth in demand from developing Asian countries, the share of developing countries as a whole in the world total grew from 10.3 per cent to 16.7 per cent between 1980-1982 and 1990-1992.

14. The acceleration of the growth of copper consumption in developing Asia and in China at the end of the 1980s made up for the slump in demand that occurred in the countries of Eastern Europe and thus sustained the growth of total world consumption. Demand in the latter region had grown at a very slow pace between 1980 and 1986, but began falling as early as 1987 and slumped in the years 1990-1992. This was attributable to the beginning of the transition from centrally planned economies to market economies. The disruption of economic structures brought about a sharp fall in economic activity, including industrial production. Between 1986 and 1992, total consumption in Eastern European countries fell by 41.4 per cent. In the republics of the former USSR (which account for around 75 per cent of the region's total) it dropped by 38.5 per cent.

B. Intensity of use

15. Average **intensity of use** of copper worldwide (IU, defined as the quantity of the metal consumed per unit of constant GDP) declined over the last 30 years as it fell in all regions except for developing countries (chart 1 and table 3). In developed countries (which account for two thirds of world copper consumption) it fell markedly from the mid-1960s to the mid-1970s and during the first half of the last decade. This was caused by: substitution by other materials (particularly aluminium, steel and plastic); downsizing and miniaturization; the changing composition of GDP in industrialized countries, i.e., the decreasing share of manufacturing (responsible for the bulk of copper demand) in the economy; and economic recession (during economic downturns, copper consumption has tended to fall more sharply than overall economic activity).

16. During the 1980s, intensity of use of copper in the United States (which accounts for one fifth of world consumption) dropped more markedly than in other industrialized countries. This reflects basically the increase in imports of copper-containing products (cars, motors, electrical appliances, etc.), rather than a sharp fall in the final consumption of the metal.[3] In the early 1990s copper IU in that country fell at a quicker pace, because of the economic downturn.

17. Copper intensity of use took a different direction in other developed countries. In both Western Europe and Japan (which account for 28.6 per cent and 14.3 per cent of world consumption, respectively) it stabilized or even rose slightly since 1987. This signified the reversal of the downward trend that had started in the early 1960s in Western Europe and at the beginning of the 1970s in Japan. The combination of divergent trends among industrialized countries caused overall intensity of use of copper for the group to drop only marginally since the mid-1980s.

18. This situation of falling or constant intensity of use of copper in industrialized countries contrasts sharply with developing countries. There, IU grew vigorously since the mid-1960s and from 1986 onwards was higher than that of developed countries. The different economic performance of the various regions was responsible for this development. Intensity of use of the metal grew at a quick pace in Latin America during the 1960s and the 1970s. However, it receded markedly during the last decade, due to the economic crisis undergone by the region. In developing Asia, rapid industrial growth made copper intensity of use increase at a very quick pace from the second half of the 1970s onwards. The

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[3] Statistics for copper consumption measure the use of the metal in the production of copper and copper-alloy semimanufactures. They do not wholly reflect final consumption of copper-containing products in individual countries, due to international trade in semimanufactures and in products containing them.

tempo of growth there was the fastest of all regions shown in table 3. Growth was especially strong in Taiwan, Province of China, the Republic of Korea, Turkey, Malaysia and Thailand. In all these countries, copper intensity of use is now higher than the level reached by developed countries (including Japan) over the last 30 years. This is due to the importance of copper-intensive sectors like the electrical and car industries in their economies, as well as to the growing infrastructural requirements generated by rapid industrialization. In Africa, on the other hand, IU grew during the 1970s and the second half of the 1980s, but is still less than half the average of developing countries.

19. Intensity of use of copper in countries of Eastern Europe was between twice and three times higher than the level of developed countries over the last 30 years. This striking difference is due to:

- the methodological difference between calculating gross domestic product (used for Western countries) and net material product (NMP, applied in Eastern European countries until recently). The fact of not including most services in the calculation of NMP and of using a "net" (as opposed to "gross") measure of economic activity underestimates national production as compared to the GDP methodology. Consequently, IU is overestimated;
- the predominance of heavy industry in the economy of Eastern European countries, as opposed to the larger share of high technology industries and services in the GDP of developed countries. The different composition of the economy leads to a higher consumption of copper per unit of overall product in the region;
- higher relative copper consumption probably also reflects a less efficient use of the metal in Eastern Europe as compared to its use in developed countries.

20. The same reasoning applies broadly to China.[4] Intensity of use of copper had been roughly double that of developed countries since the early 1960s. However, it has been declining since 1978, when economic reforms began to be carried out, because the economy grew at a quicker rhythm than copper consumption. Over the last 15 years the country's economy expanded at an annual rate of 9 per cent, while copper consumption increased by just 4.4 per cent p.a..

21. Another way of comparing copper consumption across countries and at different time points is to consider **per capita consumption** (table 4). Chart 2 shows the evolution of the growth of per capita copper consumption since the 1960s in each of the three regions considered and China. Per capita consumption has followed an upward trend in developed and developing countries, including China. In the countries of Eastern Europe, however, it stagnated during most of the 1980s and fell sharply from 1988 onwards, for the reasons explained in section A above.

22. Developed countries have the world's highest level of per capita copper consumption. Over the last 30 years the highest growth rate among them occurred in Japan. There, it increased from 3.7 kg Cu per person in the early 1960s to 12.3 kg per capita at the beginning of the present decade. In Western Europe, it grew continuously over the same period, reaching the same level as that of the United States by the early 1990s (8.3 kg per person). In the United States, on the other hand, per capita consumption followed the opposite direction. It fell consistently from the level of 9.6 kg per person in the second half of the 1960s to the present level of 8.3 kg per capita. This is explained by most of the factors that caused a fall in the intensity of use of copper there.

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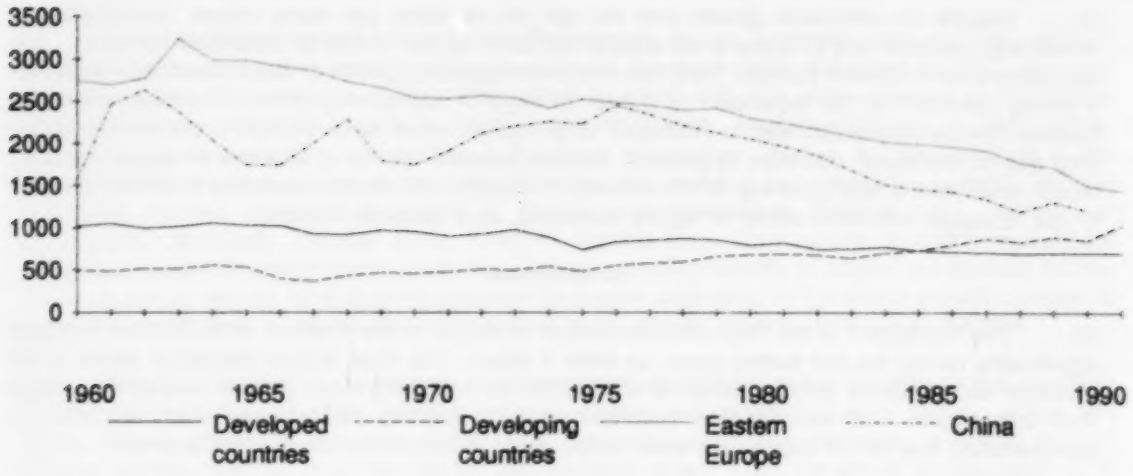
[4] For this country, intensity of use was calculated using national income, which is considerably lower than GDP and thus tends to overestimate IU when compared to other countries. It is important to keep in mind that data for China (both for copper consumption and for national income) may not be as accurate as in the case of other countries.

Chart 1

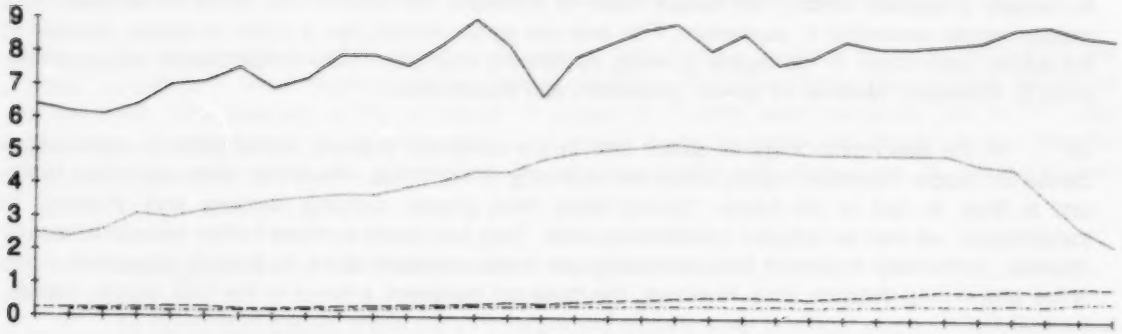
Intensity of use of copper, 1960-1991
(kg Cu/1985 US$ million GDP or NMP)



Source: UNCTAD secretariat.

Chart 2

Per capita copper consumption, 1960-1992
(kg Cu/person)



Source: UNCTAD secretariat.

23. As in the case of intensity of use, the growth of per capita consumption of copper was highest in developing Asia. There it increased from 0.1 kg per capita at the beginning of the 1970s to 0.9 kg in the early 1990s. The countries that attained the highest per capita copper consumption in that region were Taiwan, Province of China (18 kg), the Republic of Korea (7.8 kg) and Malaysia (3.2 kg). In China, consumption per person increased particularly between the mid-1960s and the mid-1970s and from 1985 onwards, but was still only around 0.5 kg in the early 1990s.

24. Despite its continuous growth over the last two decades, per capita copper consumption in developing countries and in China is still around one tenth or less of that of developed countries . It is also lower than in Eastern Europe. Thus, the continued economic growth of those countries represents a strong potential for the expansion of copper demand in the coming years. Economic growth of Eastern Europe would also lead to increased consumption, since its consumption per person is one third that of developed countries at present. Another possible source of increase in copper demand would result from a strengthening of the recovery in Europe and Japan, assuming that their intensity of use of copper remained stable or slightly increased, as it has done recently.

C. End-uses

25. The distribution of the main end-use sectors of copper in the Western world has not changed significantly during the last twelve years, as table 5 shows. The main copper-absorbing sector is the electrical and electronic industry, which is responsible for a growing share (almost half) of the metal's final consumption. The second most important sector is building construction, which accounts for approximately one fifth of copper end-uses, followed by industrial machinery and equipment.

26. In the United States, the most important sector of application for copper is building.[5] Its importance as a copper consumer grew over the 1980s, coming to account for almost half the demand for copper. This sector expanded in the United States to the detriment of all other end-use sectors. The second most important application of copper in that country is in the electrical industry (which includes power utilities, telecommunications, business electronics, lighting and wiring devices).

27. One of the main applications of copper in the **electrical and electronic industry** is power generation and transmission. In this field, copper lost a significant part of its market since the 1960s to aluminium for overhead power cables and power transmission grids, due to aluminium's better conductivity-weight ratio. However, where those devices have to be placed underground (especially in densely populated areas), the weight factor is irrelevant but volume has to be considered. This makes copper preferable to aluminium. This end-use sector should give a boost to copper demand in the future, particularly in the rapidly growing developing countries. Their infrastructural requirements point to increased demand for power generation and transmission.

28. In the telecommunications sector and in the computer industry, substitution of optical fibre cables for copper increased rapidly since the beginning of the 1970s. This trend continued in the 1980s and is likely to last in the future. Optical fibres have greater carrying capacity and efficiency in transmission, as well as reduced maintenance cost. They are bound to make further inroads in copper markets, particularly in view of their increasing use in telecommunications in densely populated urban areas and in long-distance links. However, this does not represent a threat to the total copper market,

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[5] Data for the West and for the United States presented in table 5 are not totally comparable because they are based on different classifications of end-use sectors. Building construction in the case of the United States, for instance, includes such items as wiring, heating, air conditioning and commercial refrigeration, which in other countries are classified as electrical industry. This explains why the U.S. Bureau of Mines, despite using CDA data but extracting the electrical component from other end-use sectors, concludes that the share of the electrical industry in all end-uses in the United States was 73.5 per cent for 1990-1991 (USBM, *Minerals Yearbook 1991*, chapter on copper). This is substantially higher than CDA's own figure (25 per cent).

since optical fibres compete with copper for just 5 per cent of its end-uses.[6] In long-distance telecommunications, copper use also fell because of the substitution of radio equipment and artificial satellites for copper cables during the 1970s and 1980s. This trend seems to be irreversible, given the technical superiority of the newer technologies. Thus, the intensity of use of copper in telecommunications decreased considerably over the last 20 years. However, copper consumption by that sector was underpinned by the expansion of the sector in both developed and developing countries.

29. In the **building construction** sector, the intensity of use of copper grew over the 1980s in industrialized countries. The trend towards replacement of copper pipes and tubes by PVC, steel and aluminium tubes that emerged in the 1970s came to a halt and was even reversed in the 1980s. Copper regained market because of its durability and recyclability. Another application in which copper use has increased recently is in roofing. It has been increasingly used in building because of the widespread introduction of both commercial and consumer electrical and electronic products, and the increasing number of electrical motors in houses and commercial buildings (e.g., alarms, air conditioning, electrically operated doors, windows, lighting, etc.). They require an increasing amount of cable for electricity transmission, plugs etc..[7] As this growing intensity of copper use spreads to new buildings and to already existing ones, demand for copper originating in this sector should increase in the future, particularly in developed countries and in the rapidly growing developing countries.

30. Copper demand in the **industrial machinery and equipment** sector is highly cyclical and from the mid-1970s to the mid-1980s suffered from downsizing and miniaturization of motors, valves and fittings. These processes, however, seem to have slowed considerably since the middle of the last decade, as they reached their commercial and technical limits.[8] Thus the sector should continue to consume copper in the future, but with a high degree of cyclical volatility.

31. Automobiles account for the bulk of copper use in the **transportation** sector (the balance corresponding to trains, airplanes and ships). In developed countries, copper has suffered from substitution by aluminium in radiators, due to the latter's weight advantage. It has, however, been increasingly used for electrical transmission, given the growing number of electrical motors and electronic sensors in vehicles. Thus, the average intensity of use of copper wire in United States vehicles doubled between 1980 and 1989 to approximately 10 kg Cu per car. It is forecast to double again up to 1995. By then the relative consumption of the metal by the automobile industry is likely to reach its peak. However, even if the intensity of use of copper declines afterwards, copper demand will probably be sustained by the absolute growth in the number of vehicles produced.[9]

32. The substitution of other materials for copper may imply a permanent loss of market for the metal (as seems to have happened in the case of satellites and optical fibres) but may also be halted or reversed. One example is the comeback of copper in housing uses previously lost to PVC and aluminium. Another possibility of consumption expansion is the discovery and spread of new uses for the metal. In both cases the substitution for and by copper will depend on its economic and

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[6] Metallgesellschaft, *The World of Metals - Copper*, Frankfurt, 1993, p. 113.

[7] As mentioned before, these uses of copper are classified as "building" in the United States but as "electrical industry" in other countries.

[8] ECLAC, *Oportunidades de crecimiento y opciones tecnológicas para la industria del cobre en América Latina y el Caribe*. Santiago, 1991, p. 36.

[9] Billiton-Enthoven Metals, *Copper Market Report*, London, 1992, p. 30. The report also points out that the likely expansion in production of electrically-powered vehicles (particularly in developed countries) over the medium term will provide a strong boost for copper consumption. It should raise the use of the metal both in the transport sector (through its direct use in the manufacturing of those vehicles) and in the power generation and transmission sector (due to increased electricity demand).

technological advantages *vis-à-vis* other materials.

33. The spread of substitution and the falling intensity of use of copper in developed countries since the 1960s forced the copper industry to change its attitude towards promotion of the metal. Until the aftermath of the Second World War, copper consumption had increased continuously and the main concern of producers had been how to meet growing demand. In the 1960s, however, they started investing in copper promotion, but still in a limited and uncoordinated way. Their cooperation was hampered during the 1970s and the early 1980s by the confrontational stance prevailing among them over that period. Simultaneously, the industry continued to face the threat of substitution and in the early 1980s it faced a long period of depressed prices and sluggish demand. There was a general impression that the depressed state of the market would last over the medium term. This led the major players of the industry to change their policy towards copper promotion and research and development. They significantly expanded their investment in them, with the aim of increasing consumption of the metal. This was done basically through the funding of copper development associations and entities in both producing and consuming countries and through the establishment of the International Copper Association. Codelco, the largest primary producer, for example, raised its expenditure on copper promotion and research from US$ 905,000 in 1986 to US$ 3.4 million in 1991.[10]

D. Conclusion

34. The prospects for world copper demand in the coming years are not as bleak as forecast during most of the 1980s. In developed countries, demand for the metal is likely to continue growing at a slow but sustained pace, especially if the reversal of the fall in intensity of use in Europe and Japan continues in the coming years. Consumption is likely to originate mainly from technologically advanced applications in end-use sectors like the electrical industry, building and transportation. In developing countries, a continuing rapid expansion of copper consumption is foreseen, originating particularly in the accelerated pace of industrial growth and the consequent growing infrastructural needs. The most dynamic areas in terms of additional copper demand will probably continue to be South and South-East Asia and China. In Latin America the prospects for copper demand expansion are positive, though the region is not forecast to grow as fast as Asia. The possibility for copper demand growth in Africa is limited by the region's poor economic growth prospects.

35. Eastern Europe, on the other hand, has a strong potential for the expansion of copper consumption if the restructuring of its economies allows steady growth in the future. Its average per capita copper consumption is now about one third of that of developed countries. Even before it fell drastically in the late 1980s, it was approximately 40 per cent lower than in industrialized countries. If those countries' economies expand continuously in the coming years, copper demand would come mainly from building and infrastructural requirements.

36. Despite the depressed state of the market at present, copper consumption in the coming years is forecast to grow at a quicker pace than during the last decade, given the positive perspectives mentioned above. Billiton envisages a 2-2.5 per cent p.a. expansion rate for Western consumption until the end of the century.[11] The United States Bureau of Mines (USBM) forecasts it to grow at an annual rate of 3.2 per cent during the same period.[12] For total world demand the USBM points to a still higher annual growth rate of 3.46 per cent. This suggests that copper consumption is expected to rise at a quicker pace in Eastern Europe and China than in the West. If either forecast proves true, this would mean the reversal of the slow consumption growth of the 1980s and, possibly, the 1970s. Demand would be expanding more rapidly than in the last decade (when its growth rate was 1.3 per cent p.a.)

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[10] Jorge Bande, "Key strategic issues for the development of CODELCO in the 1990s", *Natural Resources Forum*, August 1991, p. 188.

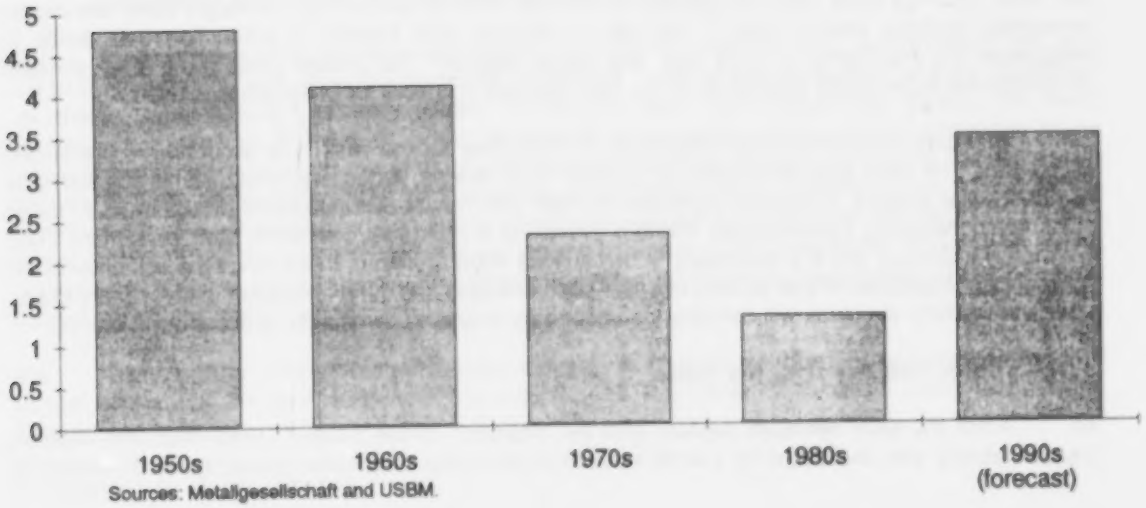
[11] Billiton-Enthoven Metals, *op. cit.*, p. 36.

[12] USBM, *op. cit.*, chapter on copper.

and than during the 1970s (2.3 per cent), if the Bureau's forecast proves true (chart 3). The USBM's projection is more positive for the first years of the twenty-first century. Consequently, the average annual expansion rate for the 1991-2005 period is forecast by the USBM to be 3.35 per cent in the West and 3.7 per cent for the world total.

Chart 3

World refined copper consumption growth, 1950-2000
(% p.a., average for each decade)



Sources: Metallgesellschaft and USBM.

II. SUPPLY

A. Industry structure

37. This section reviews the changes undergone by the unwrought copper industry since the 1960s and identifies the major actors in this sector. It then examines the main factors that will affect the industry in the coming years, e.g. the strategies adopted by the companies, internationalization and privatization.

38. The analysis is largely based on capacity data for most copper producing plants of the Western world at the stages of mining, smelting and refining.[13] They are attributed to ultimate holding companies according to ownership (which does not necessarily coincide with control).[14] Only one-way ownership relationships have been considered and therefore companies like Metallgesellschaft, Asarco, and MIM Holdings have been considered as ultimate holding companies, although there are cross-ownership relations among them.[15] The use of capacity data instead of production data tends to exaggerate the importance of firms operating below capacity[16] but *grosso modo* the relative position of companies is the same whichever of the two methods (capacity or production) is used.

39. The data compiled include projections of capacities for the year 2000 according to plants and companies. The plant data are based on capacity close-downs, reductions, expansions and start-ups as foreseen at present. Company capacities for that year have been calculated on the basis of these plant data considering the ownership relations prevailing in mid-1993. Therefore, data for the year 2000 are merely indicative and it is necessary to be cautious while analyzing them, since the actual outcome of productive capacities will be subject to unforeseen changes and the modification of investment plans, while the industry structure will certainly be shaped by changing ownership relations (see below).

1. The copper industry until the 1980s

40. From the early twentieth century until the aftermath of the Second World War, the Western copper industry was dominated by a small number of producing companies (basically North American)

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[13] The restriction to the Western world is due to the lack of detailed plant information for the countries of Eastern Europe and for the socialist countries of Asia.

[14] This method tends to understate the production capacity of companies that are controlled by a parent corporation but are only partially owned by it. Most of Brascan's (Canada) mining, smelting and refining operations, for instance, are owned through Noranda, in which Brascan has a 55 per cent stake. Likewise, the bulk of Metallgesellschaft's (Germany) mining assets are held through Metall Mining Corp. (Canada), while at the smelting and refining stages most of the operations are owned through Norddeutsche Affinerie. Metallgesellschaft owns 69 per cent and 35.5 per cent of the shares of these companies, respectively, and consequently that is the degree to which their capacities are attributed to it. Capacity corresponding to shares of companies owned by the public has not been attributed to any institution.

[15] As of mid-1993, Metallgesellschaft's subsidiary Metall Mining Corp. owned 14 per cent of MIM Holdings (Australia), which held a 3.5 per cent stake in the German company. The same Australian group owned 25 per cent of Asarco (United States), which in its turn held 19 per cent of MIM's shares. The South African group Anglo American Corporation (AAC) partly owns De Beers (another South African holding company) and Minorco (based in Luxembourg) and is partly held by them. The group's directly and indirectly owned productive capacities have been attributed to AAC, since it is the effective motor of the group's base metal mining policies.

[16] This is the case especially of Gécamines (Zaire) and ZCCM (Zambia). Since they have continuously operated below nominal capacity during the last 15 years, their shares in the world copper industry have been overestimated.

with a high degree of concentration. In 1948, the five leading producers (four from the United States) controlled 60 per cent of total Western output (table 6). They operated as an oligopoly with the power to fix producer prices at levels different from those established on the free market through metal exchanges. Their high degree of vertical integration and the structural production overcapacity maintained by them constituted powerful barriers to the entry of new firms.

41. This situation changed radically during the 1960s and 1970s, because of the following developments:

- the expansion of Japanese and German companies as copper smelters and refiners and their drive to secure sources of concentrates by financing new mining projects abroad;
- nationalizations in the largest producing developing countries (Chile, Peru, Zaire and Zambia);
- the entry of new producers, like smaller mining firms and energy companies;
- the growing substitution by other materials, especially aluminium, plastic and steel.

42. As a consequence of those processes, the industry became less concentrated and less vertically integrated, with domestic interests controlling most of the production in their respective countries. These included Codelco (Chile), ZCCM (Zambia)[17] and Gécamines (Zaire), the newly established state-owned companies, which became the three largest primary copper producers of the Western world. With the decrease in the market power of industry leaders, producers had increasing difficulty in fixing prices and in 1978 the companies of the United States abandoned the producer price system as such. Although producer prices formally continued to exist (and still do), they started following closely the level of the market price formed in Comex. The main factor of competitiveness became the ability to keep costs low, as opposed to the maintenance or expansion of market share sought during the earlier period.

43. The structure of the Western copper industry as shaped by those developments remained largely stable until the late 1980s, with the exception of North America, where it underwent a major restructuring process.

2. Changes in North America

44. The companies from the United States had their competitive position impaired by the loss of operations through nationalizations in developing countries at the end of the 1960s and during the 1970s. Subsequently they became "inward looking and complacent, and seemingly oblivious to the rapid strides of the industry overseas".[18] Being at that time high cost producers, those companies were seriously affected by: slackening demand and continuous low copper prices in the late 1970s and, in particular, the early 1980s; the increase in mandatory expenditure on environmental protection; energy price hikes; and the strengthening of foreign competition in the form of increased imports. Responding to the crisis undergone during the first half of the 1980s, the North American industry at first reacted by asking for protection against imports, but this was refused by the Government. Some companies then decided to leave the copper industry by selling their operations. Others adopted a long-term commitment to it, by concentrating on copper (instead of diversifying into other metals) and expanding their position in the industry.[19]

45. They sought to reduce costs and increase productivity, so as to survive and regain international

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[17] ZCCM as one company controlling the bulk of Zambian copper operations was not incorporated until 1982 but the nationalization process in the country started in the late 1960s.

[18] Phillip Crowson, "Geographical shifts in the competitive strength of mineral production since 1960, and their causes", *Resources Policy*, December 1992, p. 257.

[19] Gary Campbell, "The response of the US companies to changing market conditions", *Resources Policy*, December 1989.

competitiveness. For this purpose they took the following operational measures:

- permanent or temporary closure of high-cost operations. Between 1980 and 1986 the mining capacity of the United States was reduced by almost one third, while smelting and refining capacities fell by approximately 40 per cent;
- mining of high-grade ores;
- changes in the design and operation of mines so as to save energy and reduce stripping ratios;
- increase of leaching of waste dumps, low-grade material and *in situ* leaching, including some mines where concentration operations were suspended;
- modernization of operations and introduction of new technologies, like solvent extraction-electrowinning (SX-EW);
- streamlining of the organization and of company management;
- reduction of labour costs through lay-offs, renegotiation of contracts and wage cuts;
- adoption of training schemes to improve labour productivity.

46. These measures brought about a reduction in direct operating costs from a national average of 87.4 c/lb in 1982 to 68.0 c/lb in 1985 and 60.1 c/lb four years later, in 1991 dollar terms[20] (see also chart 4).

47. In terms of ownership, the restructuring process took the form of the sale of large mining, smelting and refining operations among companies. In some cases, the inflow of new capital allowed companies to partly finance their modernization. These ownership changes, coupled with the permanent closure of plants, resulted in some large companies that had previously been leaders of the industry disappearing or becoming minor participants. Anaconda, Kennecott and Amax had been among the industry's five leading producers during the 1930s until the 1960s (table 6). Their market strength was impaired by the loss of international operations through nationalization in the late 1960s and early 1970s (which limited them to their domestic operations) and by the strengthening of environmental regulation in the United States during the 1970s. The final blow came with the long market downturn of the early 1980s. Anaconda ceased to exist as its assets were sold out in 1985 and Amax became a minor company in copper after the loss of its interests in Zambia. Kennecott continued producing but sold most of its operations by the mid-1980s, keeping just one mine-smelter-refinery complex (Bingham Canyon). The take-over of these firms by energy companies (Anaconda by Arco in 1977 and Kennecott by Standard Oil Company of Ohio in 1982) did not prevent their decline. In 1989 Kennecott became part of the RTZ group.

48. Among the other companies that continued operating, the most important ownership changes were Duval's and Inspiration's merger into Cyprus in 1985 and 1986, respectively, and Newmont's spin off of Magma as an independent company (holding its United States operations) in 1988. Newmont also transferred its African holdings to the Anglo American group and disposed of its other major international mining and processing assets.

49. The restructuring and ownership changes in the United States led to an increase in concentration, higher vertical integration and a change of firms in the leading positions. In 1980, the four largest companies of the country in terms of capacity owned domestically were Kennecott, Phelps Dodge, Anaconda and Duval, which together accounted for 60 per cent of national mine capacity. In 1990 the four most important firms were Phelps Dodge (the only one to have maintained a leading position), Cyprus, Magma and Asarco, which controlled 70 per cent of mining capacity in the United States. The strengthening of their positions and the gain in competitiveness allowed the North American companies to go overseas and accelerate their international expansion from the late 1980s onwards.

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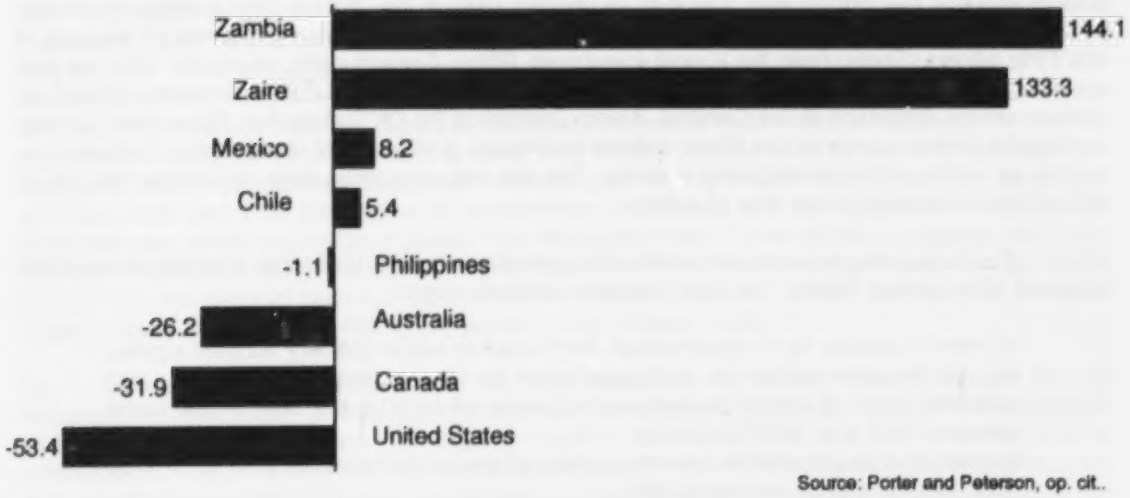
[20] Brook Hunt and Associates data quoted by I. Marshall, E. Silva and A. González, "The competitive strategy of Codelco and other leading copper producers. Changes during the last decades", *Resources Policy*, June 1993, p. 93.

Chart 4

Change in copper cash production costs, 1981-1988
(in real terms, %)



Source: Porter and Peterson, op. cit..

50. Another important aspect of these ownership changes was the exit of energy companies from the copper industry. During the 1970s and the early 1980s several petroleum companies had invested in copper mining by acquiring already existing companies.[21] This particularly affected United States copper producers, so that, in 1980, 41.4 per cent of national mining capacity was directly or indirectly held by energy companies.[22] The oil firms were consequently affected by the crisis and restructuring undergone by the American copper industry. They did not reap the profits from copper that they had expected when entering the industry and consequently disposed of most of their metal operations located in North America.

51. In some cases the companies owned by energy corporations disappeared (like Anaconda), but the majority of operations were sold by them to mining and processing companies that were already established in the industry. The largest transaction of this sort was the sale of the bulk of British Petroleum's mining, smelting and refining interests to RTZ (United Kingdom) for US$ 4.3 billion in 1989, which made Kennecott a wholly-owned subsidiary of RTZ. Other examples of the exit of oil companies from the copper industry were: the sale of Copper Range Company by Louisiana Land to Echo Bay Mines in 1985; the spin off of Cyprus as an independent entity from Amoco in 1985; and the sale of Falconbridge to Noranda and Boliden by Superior Oil in 1989. As a consequence of the exit of oil companies, by 1990 their holdings of North American copper producing capacity had been reduced to an insignificant amount.

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[21] For the reasons that drove them into the copper industry, see Kenji Takeuchi, John Strongman, Shunichi Maeda and C. Suan Tan, *The world copper industry. Its changing structure and future prospects*, Washington, World Bank, 1987, p. 83 and UNCTAD, *Studies in the processing, marketing and distribution of commodities. The processing and marketing of copper: Areas for international co-operation*, United Nations publication, Sales No. E.84.II.D.24, New York, 1984, p. 43.

[22] For our purposes, energy companies are considered as those (basically petroleum) firms that at some time entered the copper industry by acquiring already existing companies or plants (including the Kuwait Investment Office). It is a different case from some important copper companies that are part of large diversified groups with affiliates also in the energy industry, like BHP and MIM Holdings (Australia), Freeport McMoRan (USA) and Noranda (Canada).

52. Overall the share of Western copper mining capacity held by oil companies fell from 9.8 per cent in 1980 to 2.8 per cent ten years later. Oil companies from outside North America that had entered the copper industry also left it in the late 1980s and early 1990s. BP, which had transferred most of its mining assets to RTZ in 1989, sold 61 per cent of Les Mines Selbaie (Canada) to its partner Billiton in October 1992; five months later, it sold its 49 per cent stake in the Olympic Dam complex (Australia) to its partner Western Mining Corp.. Also in 1993, Freeport McMoRan (USA) acquired 65 per cent of Río Tinto Minera (Spain) from the Kuwait Investment Office. Consequently, as of mid-1993 the only remaining petroleum companies with significant copper operations were Exxon (basically through its Chilean affiliate Disputada de las Condes), Amoco (partner of the Ok Tedi mine in Papua New Guinea) and Shell's Billiton (owner of Les Mines Selbaie in Canada, a 10 per cent share of the Cuajone mine in Peru as well as some development projects). The last two companies were negotiating the sale of their mining operations at the time of writing.

53. The Canadian copper industry underwent changes during the 1980s that resemble those which occurred in the United States. The most important of them were:

- in order to increase its competitiveness, the Canadian copper industry adopted a policy of cost reduction similar to that undertaken by United States companies. Cash operating costs of copper production in Canada fell by 31.9 per cent in real terms between 1981 and 1988[23] (chart 4);
- operations were streamlined and the number of producing mines fell from 57 in 1980 to 38 in 1992 and 31 two years later;
- ownership of operations and companies was restructured. The most important transactions in this sense were: the establishment of Highland Valley Copper Corporation in 1986; the incorporation of Metallgesellschaft's subsidiary Metall Mining Corp. in 1987 and the building of ownership links with Teck Corp., Cominco and MIM Holdings; the acquisition of Falconbridge by Noranda and Boliden in 1988; and RTZ's disposal of its holding in Río Algom in 1992;
- the total number of firms producing copper in Canada fell as a result of plant closures and ownership restructuring;
- the degree of internationalization of the Canadian copper industry increased in two ways: the presence of foreign companies as owners of domestic operations increased and the investments of Canadian companies in copper mining abroad grew quickly from the mid-1980s onwards (see below).

3. The leading firms and their strategies

54. The largest producers in the unwrought copper industry in mining, smelting and refining in 1980, 1990 and 2000 are shown in tables 7 to 15 and the results are summarized in table 16. There is a considerable degree of concentration among the five largest companies at all stages and, to a lesser extent, among the first ten producers. The highest degree of concentration occurs at the mining stage, in which the five largest companies controlled approximately 38 per cent of capacity between 1980 and 1990, though this share could decrease slightly until the end of the century.[24] The degree of concentration is, however, considerably lower than that prevailing on the eve of the nationalization process in developing countries. In 1969 the five leading firms controlled 47 per cent of Western copper production (table 6). The market share of the industry leader nevertheless remained constant since the 1960s, though the company itself changed. During the 1960s, Kennecott and/or Anaconda controlled

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[23] Kenneth E. Porter and Gary R. Peterson, *The availability of primary copper in market economy countries. A minerals availability appraisal*, Washington, USBM, 1992, p. 18.

[24] It is important to recall that the figures for concentration and indications of largest companies for the year 2000 presented in tables 6, 9, 12, 15 and 16 are just indicative, since they are based on ownership relations and production plans prevailing at the time of writing. These are, however, likely to be changed in the coming years, as mentioned before.

between 13 and 15 per cent of Western copper production (the two companies produced similar quantities of mine copper). Over the 1980-2000 period, Codelco (Chile) accounts for the same share of Western mining capacity.

55. Codelco is also the largest producer at the smelting and refining stages, in which it owns between 8.5 and 11 per cent of world capacity over the 1980-2000 period.[25] In 1980 the degree of concentration of the ten largest producers at the smelting stage was similar to that of refining but lower than that of mining. This is due to the importance of the metallurgical industries of the two main copper ore importing countries, namely Japan and Germany. Whereas there were no Japanese or German companies among the 30 largest mining companies in 1980, at the smelting and refining stages six Japanese and three German companies were present among the 30 most important producers. Between 1980 and 1990 the degree of concentration in smelting and refining decreased due to the commissioning and/or expansion of plants in the developing world. Consequently, companies like Lucky Goldstar (Republic of Korea), Industrial Minera México and Cobre de México (Mexico), Caraíba Metais (Brazil) and the National Iranian Copper Industries (Islamic Republic of Iran) became part of the 30 largest copper smelting and refining companies of the Western world.

56. At present the main strategies for the future adopted by the leading copper producers are cost reduction, environmental control, exploration, mine development, internationalization and strategic alliances.[26] Over recent years the industry leaders have turned to a policy of closer mutual collaboration. This contrasts with the confrontational stance among the largest producing companies that prevailed during the 1970s and the beginning of the 1980s. Their collaboration takes basically two forms: joint funding of copper promotion and research on new uses for the metal (see chapter I); and the establishment of strategic alliances among companies. These strategic alliances are institutionalized through:

- equity participation, for example Trelleborg's and Brascan's joint ownership of Falconbridge and the crossed share ownership between Metallgesellschaft, MIM Holdings, Asarco and their joint control of Cominco;
- the establishment of joint ventures for development of large projects. Most of the largest recent copper projects are joint ventures. La Escondida (Chile) is owned by BHP-Utah (Australia), RTZ (United Kingdom), Jeco (a Japanese consortium) and the International Finance Corporation. The Papua New Guinea State's partners in the Ok Tedi mine are Amoco (USA), BHP (Australia) and Star Mountain (a company owned by German firms and a credit agency). Even Codelco (Chile), which during the 1980s faced confrontation from foreign private companies, will begin to establish joint ventures with private (and especially foreign) partners. El Abra project is to be developed by Codelco together with two North American companies.

4. The internationalization of production

57. As a consequence of the nationalizations of the copper industry in developing countries during the 1960s and the 1970s, at the beginning of the last decade the bulk of copper mine, smelter and refinery production worldwide was controlled by domestic interests.[27] These were mostly private companies in the case of industrialized countries and state-owned corporations in developing countries (as well as in socialist countries). During the 1980s, however, a tendency towards the increasing internationalization of copper production emerged and is likely to strengthen in the coming years. In 1980, 82.6 per cent of world copper mining capacity was owned by companies operating in their

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[25] In 1980 Kennecott was the largest refining company (with 10.3 per cent of the world total capacity) but most of its plants were closed down in the following years, so that in 1984 its refining capacity had been reduced by 80 per cent.

[26] Marshall *et al.*, *op. cit.*.

[27] UNCTAD, *op. cit.*, pp. 13-15.

countries of origin, whereas this proportion fell to 76.5 per cent in 1990 and is bound to be further reduced to 67.7 per cent by 2000 (table 17).

58. The degree of internationalization is considerably higher in copper mining than in smelting and refining. The presence of firms from developed countries in these two processing stages has been considerably stronger than in mining, even after nationalizations. The reason is that smelters and refineries have traditionally tended to be located closer to consuming markets rather than next to mines. The share of plants located in developed countries is therefore larger in the case of smelting and refining than in mining. Naturally, they were not affected by the nationalizations that occurred in developing countries. This explains why companies from developed countries already have a stronger position in smelting and refining, as compared to mining. They are now expanding abroad to tap the resources of mineral-rich countries and thereby strengthen their position at the mining stage. However, in the same process, they are also investing in smelting and refining plants located abroad. This trend is bound to continue in the future. The share of Western smelting capacity owned by foreign companies is projected to rise from 11.1 per cent in 1980 to 18.1 per cent by 2000 (table 18). In refining that proportion should more than double from 5.9 per cent to 16.4 per cent over the same period (table 19).

59. The internationalization process is fundamentally a consequence of the expansion of mining companies of developed countries into developing countries, especially through investments in Latin America,[28] South East Asia and Oceania. In the first region, the presence of foreign capital in copper mining has been strongest in Chile and has also been strong, although less so, in Peru and Mexico. It is likely to be the case in Argentina and Brazil as well in the coming years. In Asia, the countries that have attracted more foreign investment have been Indonesia, Papua New Guinea and, to a lesser extent, the Philippines. In the case of developing Africa there has not been an increase in foreign investments in the copper industry and the presence of companies from developed countries remained basically unchanged since the early 1980s.

60. There are several reasons for the increasing international expansion of mining companies, such as the improvement of the environment for foreign investment in developing countries (e.g., through changes in mining codes and laws on foreign investment), the relatively higher availability of metal resources in these countries coupled with a lower degree of exploitation and the search for low-cost deposits by international companies. In some cases an additional reason may be the relatively lower environmental costs of mining in developing countries, as compared to those prevailing in the countries of origin of these international firms (e.g., those related to mine reclamation).

61. The main originators of foreign direct investment in copper are countries with a long experience in copper mining and metallurgy, mainly the United States and the United Kingdom (whose companies together account for more than half of all foreign investment in copper mining), as well as South Africa, Australia, Canada, Japan, Sweden and Germany.[29] The companies with the largest mining capacity held outside their countries of origin at present are RTZ (United Kingdom), Anglo American Corporation (South Africa), BHP (Australia), Asarco and Freeport McMoRan (United States).

62. The international investments in copper of North American companies are concentrated in the Pacific Rim, especially Chile, Peru, Indonesia and Papua New Guinea. Firms from the United States had 21.7 per cent of their capacity located abroad in 1980 and increased their international presence from the second half of the 1980s onwards. Thus their foreign operations should more than double

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[28] "South America remained a magnet for mining interest and increased its share of reported global project investment funding to 28%, largely due to copper-mine development and expansion plans in Chile and the results of on-going grass-roots exploration for copper/gold deposits throughout the region." (Project survey 1993, *Engineering and Mining Journal*, January 1993).

[29] One of the few examples of a company from a developing country investing in copper mining abroad is Lucky Goldstar (Republic of Korea), owner of 40 per cent of the Los Pelambres project in Chile.

between 1980 and 2000, when they will correspond to 38.1 per cent of their total capacity. Canadian companies have traditionally concentrated their production in their home country, but started to expand internationally in the late 1980s, a process which is expected to intensify in the coming years. Consequently, by the end of the century, 39 per cent of their capacity will be located abroad, as compared to just 3.4 per cent in 1980. Total mining capacity of North American firms located outside their home countries is expected to expand from 454 ktpy Cu in 1980 to 1,289 ktpy by the end of the century.

63. The highest degree of internationalization in copper mining is that of Japanese and European companies, which is explained by the relatively small reserves of the metal in their home countries. European copper firms significantly increased their international presence in copper mining during the 1980s. The main transactions in this sense were RTZ's and Outokumpu's participation in several projects, Metallgesellschaft's establishment of Metall Mining Corp. in 1987 and the acquisition of 50 per cent of Falconbridge by Boliden (a subsidiary of Trelleborg) in 1989. Consequently, copper mining capacity owned by European companies outside their home countries doubled from 389 ktpy Cu in 1980 to 806 ktpy ten years later and is expected to increase further to 1,211 ktpy by 2000. These companies invest basically in the Americas (particularly Canada and Chile), with the exception of RTZ. This United Kingdom company has highly diversified international investments in both developing and developed countries of the Americas, Africa, Asia, Australia and Europe.

64. Japanese companies are changing their form of involvement in foreign copper mining projects from financing through long-term contracts for the purchase of concentrates to direct participation as owners of minority stakes in joint ventures, like Escondida and Candelaria (Chile) and Morenci and Chino (United States). Their mining capacity owned abroad is still considerably smaller than that of the North American and European companies: 109 ktpy Cu in 1990, which should grow to 184 ktpy by the end of the century. Their capital is directed mainly to countries in the Pacific Rim.

65. South Africa's largest copper company with holdings abroad is the Anglo America group (AAC), whose foreign assets are located mainly in southern Africa, Chile and Canada. Australia's companies started investing in copper abroad only recently and their production capacity outside their country grew from 6.5 ktpy Cu in 1980 to 134.2 ktpy Cu in 1990. It is expected to increase threefold to 387.4 ktpy Cu up to the end of the century.

66. The presence of multinational mining companies in countries with large geological and economic potential is likely to be further strengthened if the most optimistic consumption forecasts prove true (see chapter V). This would cause the growth of demand to outstrip the projected supply expansions and would thus require the development of new projects (supposing a constant recycling rate). The large transnational mining corporations have the biggest reserves of investment funds and hence better chances of raising financing either through loans or equities. They would therefore be in a better position to take advantage of the improved medium- and long-term perspectives of the copper market. This would allow them to further strengthen their international position and to increase their market shares.

5. Privatization

67. Privatization will deeply affect foreign direct investment flows in the copper industry and reshape the industry structure worldwide in the coming years. As a consequence of the nationalization process undertaken during the late 1960s and early 1970s, in 1980 state-owned mining capacity corresponded to 36.1 per cent of the Western world total and 96.5 per cent of it was concentrated in developing countries. The overall state-controlled share increased slightly to 38.3 per cent in 1990, which was basically a result of expansion programmes adopted by Codelco, National Iranian Copper Industries and Minero Perú. Until the end of the century, however, state ownership in copper mining should decrease to 33.6 per cent even without any additional privatizations (which, however, are likely to happen, as will be seen).

68. The basic reasons that led to nationalizations in developing countries were the political pressures in host countries to control national mineral reserves and the desire to increase the share of mineral rent collected by the State and subsequently redistributed by it. The capacity of state-owned copper companies to accomplish the aims that led to their establishment was eroded constantly over the last ten years (in some cases since the late 1970s). The main causes of this have been:

- institutional rigidities and limitations that state ownership tends to impose on mining companies, e.g. the emphasis on maximization of short-term income in a context of price instability, which impairs their long-term capacity to generate it;
- the limited amount of financial resources and foreign exchange made available to state-owned companies, although they were responsible for the generation of a substantial part of the countries' fiscal revenues and export earnings. This lack of resources makes it difficult for the corporations to meet the maintenance and modernization requirements of existing plants and to finance expansion plans;
- greater rigidity of labour relations (as compared to private companies);
- the consequent increase in production costs,[30] which leads to corporate losses during prolonged periods of low prices.

69. This was particularly the case in Zaire, Zambia and Peru. However, these problems were also faced to some extent by a well-managed and commercially-oriented company like Codelco. The Chilean corporation is still under the obligation to transfer 10 per cent of its sales revenues to the country's armed forces, while it lacks the financial means needed to exploit its large mineral resources.

70. In summary, in some of the largest copper-producing developing countries, the State has not been able to cope with long-term production problems or has imposed constraints on the commercial development of state-owned companies. Therefore, privatization is increasingly seen by some national political leaders, pressure groups and lending institutions as the necessary way to tackle these problems. Nevertheless, privatization *per se* will not solve all the problems faced by copper producing state companies in developing countries. What is at stake is not only the sale of state-owned assets to the private sector. Privatization necessarily involves the redefinition of responsibilities for social services now provided by those companies, as well as the attribution of the financial and environmental liability generated by their operations.[31] This partly explains why the largest state-owned copper producing companies from developing countries have not yet been privatized, even though the intention

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[30] A study on state-owned mineral corporations concluded that "mineral production costs in state-owned enterprises will be higher as a result of the typical pursuit of nonprofit objectives, but the evidence of higher cost due to permanent inefficiency in unclear" (Marian Radetzki, *State mineral enterprises. An investigation of their impact on international mineral markets*. Washington, Resources for the Future, 1985, p. 143).

[31] UNCTAD, *Mineral resources and sustainable development* (TD/B/CN.1/16). Geneva, Sept 1993; and Olivier Bomsel, *The future of mining countries: new strategies or new governments?*. Report prepared for UNCTAD in 1993, forthcoming in UNCTAD/COM series.

of doing so has been expressed in several cases. The most important of these are:

State-owned company	Country	Mining capacity in 1990 (ktpy Cu)
Codelco, Enami	Chile	1,421.3
ZCCM	Zambia	736.9[32]
Gécamines	Zaire	680.3
Minero Perú	Peru	159.8
Nat. Iranian Copper Ind.	Iran, Isl. Rep. of	130.0
RTB Bor	Yugoslavia	129.4
Etibank	Turkey	66.0
Hindustan Copper Ltd.	India	59.0

71. By far the most important of the above-mentioned corporations are Codelco, ZCCM and Gécamines, which are among the four largest copper mining and smelting companies of the world in terms of capacity.

72. **Codelco** is the largest and most successful of them. It responded to the copper crisis of the early 1980s by adopting operational measures similar to those implemented by its competitors (reduction of costs, improvement of efficiency, modernization of plants), the main difference being that a central element of its strategy was the increase of production. Initially this policy was successful, since it led to the reduction in costs and to a rise in the corporation's copper output and market share. Operation costs fell from 43.7 c/lb in 1982 to 34.5 c/lb in 1985 (at 1991 prices)[33] and the corporation's share of Western mine output increased from 14.8 per cent to a peak of 17.4 per cent between 1980 and 1989.

73. However, production costs increased steadily thereafter, reaching 50.2 c/lb in 1991 (a higher level in real terms than nine years earlier), while the company's share of Western production receded to 15.4 per cent in 1992. The corporation still has generally lower production costs than its main competitors but its cost advantage was eroded over recent years because of other producers' drive to reduce costs. On the other hand, its labour productivity is considerably lower than that of its North American competitors.[34]

74. The strategy adopted by Codelco to expand production and increase competitiveness met with difficulties like declining ore grades, mine deepening, lack of exploration policies and organizational and administrative deficiencies,[35] coupled with limitations on access to capital to finance expansion projects and the environmental upgrading of its operations. Consequently, the (partial) privatization of the company is increasingly supported by some corporate managers, political leaders and pressure groups as the best way to tackle these problems.

75. The participation of the private sector in the already existing core mining divisions of Codelco (Chuquicamata, Salvador, El Teniente and Andina) is forbidden by its constituent law. Although

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[32] Total capacity of Zambian Consolidated Copper Mines. In tables 7 to 15, ownership of ZCCM's capacity has been split between Zimco and AAC according to ownership.

[33] Codelco data quoted in Marshall *et al.*, *op. cit.*, p. 93.

[34] In 1988 labour productivity in Codelco's largest mine (Chuquicamata) corresponded to one third of the productivity level of the largest North American mines (based on data from ECLAC, *op. cit.*, p. 31).

[35] "Codelco (...) did not undertake some of the tougher streamlining measures that other firms had to implement in order to survive." (Marshall *et al.*, *op. cit.*, p. 91).

company officials and political leaders have discussed the issue, it is still a politically very sensitive question. For the time being, therefore, the participation of the private sector has been limited to plans aimed at the disposal and out-contracting of non-mining activities like power generation and health. As for the core mining divisions, it is unlikely that private companies will be taking part in their production activities in the near future, although the partial privatization of Codelco's core activities by the end of the century is already being prepared. In any case, it seems clear that the State will retain a significant stake in the corporation.[36]

76. A fact that points in that direction is a law introduced in May 1992, allowing the company to form joint ventures with private partners in order to explore areas already owned by it but not assigned to one of its existing divisions.[37] This represents a strong potential for private participation in the exploitation of the country's copper reserves, since almost one third of Chile's registered mineral holdings belongs to Codelco. Moreover, the company currently operates on only a small fraction of the claims it owns. The first project to be conducted in the way envisaged should be El Abra (a planned 225 ktpy Cu SX-EW operation). It will be developed by Codelco (owner of 49 per cent) and by Cyprus Minerals (USA) and Canada's Lac Minerals (which together will account for 51 per cent of the project), two large international companies already operating in the copper industry.

77. The possibility of setting up joint ventures between Codelco and private partners will reinforce the already existing trend for a quick increase in private investments in Chilean copper mining, especially investments by international companies. Prompted by the country's large copper reserves (the largest in the world) and by the attractive environment offered to foreign investment, some of the biggest copper companies originating basically in developed countries increased their investments in the Chilean copper industry at a brisk pace from the late 1980s onwards. Eight out of the nine major new projects and capacity expansions in Chilean copper mining between 1985 and 1993 were implemented by foreign companies, adding 638 ktpy Cu to the country's mining capacity. These new projects and/or expansions accounted for 27 per cent of Chilean total production capacity by the end of that period. By far the most important of them is the Escondida mine (390 ktpy Cu capacity in 1993), owned mainly by BHP (Australia) and RTZ (United Kingdom). Between 1993 and 2000 the largest mining project scheduled for start-up in Chile is Collahuasí, at present owned by AAC Falconbridge and Billiton and scheduled to reach a capacity of 300 ktpy Cu. Several smaller projects mostly owned by the international mining companies already operating in the country are also scheduled to come on stream.

78. Because of the increase in both foreign and domestic investment in Chilean mining, Codelco's share in national copper mine capacity decreased from 81.1 per cent to 70.7 per cent between 1980 and 1990. It is expected to fall further to 43.3 per cent by 2000 (even without any privatization of its existing plants), as large projects of the private sector come on stream. Thus, by the end of the century, copper production in the largest producing country is expected to be mainly controlled by private companies. In the case of privatization of the corporation's core mining divisions, the private sector's share in national output would be even larger. The eventual acceleration of the privatization process in Chile - either through the constitution of joint ventures between Codelco and private partners for the exploitation of new deposits or through the transfer of parts of the company's existing operations to the private sector - would probably further increase the presence of those international mining companies that already have a significant weight in the international copper industry.

79. As for developing Africa, the main state-owned companies, **ZCCM** and **Gécamines** (especially

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[36] *Metal Bulletin*, 8 July 1993.

[37] According to one company official, the aims of those joint ventures are to "increase investment for exploration and mine development; strengthening the company internationally; and keeping it on the frontier of technological and managerial developments" (Bande, *op. cit.*, p. 189). The change in the law also authorizes Enami (the other, smaller Chilean state-owned mining and metallurgical company) to establish joint ventures with the private sector.

the latter), have been facing serious difficulties over recent years. The main problems are:

- increasing production costs during the 1980s and early 1990s. In both countries the cash operating cost of copper production, expressed in local currency, more than doubled in real terms between 1981 and 1988[38] (chart 4). In Zaire they almost doubled again from 76 c/lb in 1988 to 140 c/lb in 1991;[39]
- low productivity. In 1988, productivity was 7.5 tpy Cu per man in Zambia and 13 tons in Zaire, as compared to 43 tons in Chile and 60 tons in the United Sates;[40]
- low capacity utilization rate. The mines of Gécamines operated at 62 per cent of nominal capacity in 1980 and at 56 per cent ten years later. In 1992 the rate declined further to 48 per cent. ZCCM increased the mine utilization rate from 48 per cent to 63 per cent over the same period. These are still very low rates compared to the other leading producers;[41]
- declining production, particularly since 1984 (ZCCM) and 1988 (Gécamines);
- limited access to capital markets and to foreign exchange. This impairs the companies' capacity to finance the maintenance and expansion of existing operations, as well as the building of new plants.

80. Privatization of the copper companies is seen as a way to tackle these questions both by national leaders and by international lending institutions.[42] However, as mentioned above, there are some difficult questions that have to be addressed before this can be done. They refer mainly to financial, social and environmental liabilities associated with both companies.

81. The Zambian State has adopted reforms aimed at increasing efficiency in ZCCM. It intends to sell part of its 60.3 per cent stake in the company (held through Zambia Consolidated Copper Mines Ltd. - Zimco) to private interests before the end of the century. The most likely company to acquire at least part of the privatized shares is AAC. In the case of disposal of the public holding in ZCCM, the South African company has pre-emptive rights over half of it, because of its historical ties with the Zambian mining industry.[43] It has expressed its interest in the privatization, as have RTZ and Gencor (South Africa). The State will probably retain a stake in the company even if it sells part of its holding (similarly to what is likely to happen in Chile).

82. The situation of Gécamines deteriorated continuously during the 1980s and worsened in the early 1990s, partly because of political turmoil in the country. Privatization is now seen as part of the

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[38] Porter and Peterson, *op. cit.*, p. 18. The study shows, however, that during that period deficiencies in management, productivity and technology were to a great extent compensated by the real depreciation of the two countries' currencies. Consequently, cash operating costs expressed in current dollar terms rose by just 1.4 per cent in Zaire and 18.6 per cent in Zambia between 1981 and 1988.

[39] Bomsel, *op. cit.*.

[40] Bomsel, *op. cit.*.

[41] These rates refer to nominal production capacity. It is likely, however, that actual capacity was lower due to inappropriate maintenance of operations, which partly explains the reduction in output.

[42] According to the World Bank, "Given the political and social realities of most African countries today, the reform of mining parastatals requires a partial or complete privatization so that management and operational control of the company is given over to a private stockholder or stockholders." (*Strategy for African mining*, Washington, April 1992, p. 49).

[43] AAC, together with Roan Selection Trust, controlled the Zambian copper industry until its nationalization. It still retains a 27.3 per cent stake in ZCCM.

answer to the problems faced by the company both by national managers and by international lending institutions.[44] However, given the political and social situation of the country and the poor conditions of its copper industry, it is unlikely to attract foreign investment before the political, social and economic situation is somehow redressed. Once this is done, some large copper companies have expressed their interest in acquiring part of Gécamines' assets.

83. The Peruvian Government has announced for the near future the sale of **Minero Perú** (the State's largest mining company) and its subsidiary, Centromin. This way it intends to complete the privatization process already started with the disposal of Condestable, Cerro Verde and the Quellaveco deposit.[45] The Government of the Philippines has announced the sale of its stake in the country's only smelting and refining operation (Pasar) and the continuation of the disposal of mining companies like North Davao Mining Corp. and Maricalum Mining Corp.. As regards the state-owned companies of other developing countries (e.g., National Iranian Industries Copper Co., RTB Bor, Hindustan Copper), no intention of privatizing them has been expressed by their respective Governments.

84. The main privatization transactions in the copper industry to date are summarized in table 20. The most important disposal of production capacities took place in Mexico. It made Industrial Minera México (IMMSA) into the world's tenth-ranking mining company in 1990. In the same year it reached the 16th position in smelting and the 27th in refining. IMMSA was a group previously active in copper mining and refining but on a limited scale. It is 31 per cent owned by Asarco (United States). In Brazil the State retained a stake (34 per cent) in the privatized company.

85. The privatization process is also bound to affect the copper industry in developed countries. However, it is not likely to have as strong an impact on the structure of the world copper industry as the sale of public assets in developing countries. The reason for this is that the leading copper companies in developed countries are already privately owned, except for Outokumpu (Finland) and Empresa de Desenvolvimento Mineiro (Portugal). All other state-owned copper companies from developed countries control less than 1 per cent of world capacity at any of the three stages of processing. Among the privatizations already undertaken by these countries was the sale of 51 per cent of Montanwerke Brixlegg (Austria) in 1990. Italy has announced the privatization of Nuova Samin and ENI and the German Government is negotiating the disposal of Mansfeld (a concern from the former German Democratic Republic).

86. Apart from developing countries, privatization in Eastern Europe, if and when carried out, is bound to have a strong impact on the structure of the world copper industry. In 1990-1992, the region accounted for 14-15 per cent of total world copper mine, unrefined and refined production, and its industry is at present wholly state-owned. By far the largest producers of the region are the Commonwealth of Independent States (CIS) and Poland. It is still unclear how these countries intend to manage their copper industries and what will be the relation between state companies and private domestic and foreign investment.[46]

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[44] The World Bank advises Zaire to "abolish [state] operatorship, reduce ownership through privatization" and to "promote role of private sector", adding that for that purpose overall macro-economic adjustment and a revision of legislation is necessary (World Bank, *op. cit.*, annex IV, p. 11).

[45] Additionally, Tintaya was transferred by the central Government to the Inca region.

[46] Two recent examples of possible private participation have been Poland's KGHM and Russia's Udokan deposit. Asarco has made an offer to manage the Polish company (possibly with equity participation) but it was turned down. In Russia, the right to develop the Udokan orebody, said to have potential for a 300 ktpy Cu output, was initially awarded to a Chinese and Russian consortium through a tender. However, these firms withdrew in 1993 and Russian authorities approached companies like RTZ, AAC and BHP to discuss the development of the deposit.

87. "In the long run the necessity to attract investment capital for the rehabilitation of the mining and smelting industries in the formerly centrally planned economies of Eastern Europe and the Soviet Union and to save the environment will make it necessary to sell out at least parts of the industry."[47] However, this will require macroeconomic and legal changes, as well as the negotiation of social, financial and environmental liabilities. The process has much in common with that of developing countries. In both cases the question is how to transform state corporations seeking not only profits but also social and welfare goals into commercially oriented companies (which does not exclude partial state ownership). In any case, it is clear that whichever policy these countries adopt for their mineral sector and its timing will have a strong impact on the future shape of the world copper industry.

88. The changing structure of the copper industry of China is also bound to have a strong impact on the world industry in the coming years. The country accounted for 4-5 per cent of world copper output at all stages of unwrought production in the early 1990s. It is a small share but, for smelting and refining, it has been growing over the last few years. The country is likely to develop its smelting and refining facilities and to rely on foreign supplies of concentrates rather than continue importing large quantities of refined metal. In this case, it would take a path similar to that followed by Japan and the Republic of Korea.[48] Its presence in copper processing will undoubtedly increase in the near future, since there are already several smelter and refinery expansion plans under way. However, it could also become a significant actor on the international copper mining scene if it starts investing in mining projects abroad so as to guarantee at least part of the supply of concentrates for its domestic processing plants. Also in this case, it would be adopting a policy for copper similar to that implemented by Japan and the Republic of Korea.[49] It is not clear, however, how its copper industry will be institutionally and economically structured in the coming years.

6. Conclusion

89. As a result of the conjunction of developments mentioned above the copper industry will be shaped by the following trends in the coming years:

- increased internationalization of production, partially reversing the picture of production dominated by domestic companies (especially in developing countries) prevailing in the early 1980s;
- the growing importance of large transnational companies originating in the metal mining and metallurgical industries of developed countries and the geographical expansion of their activities (possibly in the former socialist countries as well). These companies will be mainly from the United States, the United Kingdom, Australia, South Africa and Canada and, to a lesser extent, Japan, Sweden, Finland and Germany;
- acceleration of the privatization process in developing countries (as well as in developed countries) and the ensuing decrease of the relative weight of state companies. However, this will not mean a return of the situation prior to the nationalizations, since the States will retain a significant stake in mining, smelting and

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[47] M. Ericsson and A. Tegen, "The corporate structure of the international mining industry: The present situation and the outlook for the mid 1990s", *Raw Materials Report*, vol. 8, No. 4, 1993, p. 7.

[48] *Metal Bulletin*, 7 October 1993, p. 7. The rise of the share of concentrates in total Chinese unwrought copper imports from 13.5 per cent to 33.4 per cent between 1980-1982 and 1990-1992 (tables 34 and 35) points in this direction.

[49] China National Non-Ferrous Metal Industries, for instance, reached pre-qualification in a tender to award the joint development of Enami's Altamira deposit (Chile) in September 1993 and is reported to be considering investment opportunities in other Latin American countries and in Australia, Africa and Russia (*Metal Bulletin*, 1 November 1993, p. 9, and 11 November 1993, p. 7). Similarly, China has adopted this policy of directly investing abroad to guarantee part of its raw materials supply in the case of iron ore, e.g., by acquiring Hierro Perú and constituting iron ore mining joint ventures in Australia.

refining companies;
- changes in the structure of the copper industry in Eastern Europe and China.

90. Some transnational companies are thus likely to spread their international presence and to increase their influence in the industry. However, this does not mean a comeback of the situation prevailing until the 1960s. The present market share of the larger international corporations is considerably smaller than that of the leading firms 30 years ago, the number of copper producers is substantially higher and state ownership will not disappear even if privatization takes place in the larger producing developing countries. It is also important to stress that, though the privatization of the largest copper companies is almost taken for granted at present, the process is highly complex. Difficult economic, political and social choices have to be made. This means that the whole process will take longer than is envisaged and may be carried out in an unforeseen way.

B. Changes in the geographical distribution of production

1. Mine production

91. World mine copper production increased steadily during the 1980s, from around 8 million tons in 1981 to above 9 million tons in 1989. However, its average growth rate (1.2 per cent per year) was considerably lower than that of the 1970s (2 per cent p.a.) and of the 1960s (4.2 per cent p.a.). Although on average this is a similar rate to that of the growth of world consumption, the developments on the supply side did not follow closely those of demand along that period. The sharp drop in copper consumption and prices in 1982 led to a cutback in world mine output, but thereafter there was a divergence between developments in supply and demand. As the latter picked up in 1983-1984, mine output was slow to react, given the drastic measures that had been taken in the preceding years. At the beginning of the 1990s, on the other hand, the expansion of mine production was maintained even when demand began to slacken. This partly explains the strong fluctuation of copper prices between 1980 and 1993 (see chapter V).

92. Of the four country groups shown in table 21, developing countries had the largest share in world copper mine production throughout the 1980s (around 45-46 per cent). Their total share remained almost constant over the decade but there were very marked differences in the regional performance inside the group. Latin America continuously increased its share in world copper mine production, more than making up for the loss in Africa's share. This increase was accounted for mostly by Chile, which in 1982 became the world's largest producer (displacing the United States - table 22). Its mine output increased at the rate of 4 per cent per year throughout the 1980s. In the first half of the decade, this was due to Codelco's capacity and production increase (in 1982-1984 the corporation accounted for 81.5 per cent of national copper production). In the latter period of the 1980s, the company continued expanding its production, though at a slower pace. Private companies increased their copper output at a very rapid pace, tripling production between 1985 and 1991, as new projects (like La Escondida mine, with an initial capacity of 320 ktpy Cu) came on stream.

93. Developing Africa experienced a reduction in its copper mine production by an annual rate of 4.1 per cent between 1980-1982 and 1990-1992. Consequently, its share in world output fell from 14.7 to 8.5 per cent over that period. This was due to the decrease in the production of Zaire and Zambia, which account for 90 per cent of the region's output. Zambian mine production peaked at 719,500 tons in 1969 and stabilized around 695 ktpy until 1976. From 1977 onwards it fell continuously at the rate of 3 per cent p.a., reaching the level of 432.6 kt in 1992. Copper output in Zaire remained steady around 505 ktpy until the middle of the 1980s. It declined at an annual rate of 13.7 per cent between 1985-1987 and 1990-1992, when it reached the level of 245,100 tpy. As a result, the country, which in 1980-1982 was the sixth biggest copper producer of the world, fell to the 11th position ten years later. The reasons for the fall in output in both Zaire and Zambia (almost totally accounted for by Gécamines and ZCCM, respectively) have been explained in section A above.

94. As regards other developing countries, there was a significant growth in copper production in Indonesia and the Islamic Republic of Iran. The increase in output in the former was due to several

expansions of capacity at the Ertsberg/Grasberg mine (from 60 ktpy Cu to 240 ktpy Cu between 1980 and 1992) and, in the latter, to the commissioning of the Sar Chesmeh mine (145 ktpy Cu capacity) in 1982. As a result of these expansions, Indonesia jumped from the 17th to the 12th position among the world's largest primary copper producers. Papua New Guinea could have seen its mine production expand quickly from 1987 onwards, when the Ok Tedi mine (with a final capacity of 190 ktpy Cu) came on stream, adding its capacity to the existing capacity of the Bougainville mine (165 ktpy Cu). However, the latter was closed down indefinitely in 1989 due to political and military turmoil on Bougainville island. Had it continued operating, the country would have a 350 tpy Cu mining capacity and might be among the seven largest mine producers of the world at the beginning of the 1990s. However, since the Ok Tedi became the only copper mine in activity, the country remained in the 14th position among the largest producers.

95. The growth of mine copper production around the Pacific Rim (including the countries of the Americas, as well as those of Asia and Oceania) over the last 30 years is partly due to the interest of the Japanese processing companies in securing a supply of concentrates for their large smelting and refining capacities. The companies and Japanese credit agencies consequently took part in the financing of mine projects in that region. Initially they awarded long-term purchase contracts to mining companies, but, more recently, Japanese involvement has taken the form of direct ownership (see section A above). The Republic of Korea followed a policy similar to that of the Japanese companies, though it did not have as strong an impact on the location of production.

96. Developed market economy countries' share in world mine copper production decreased during the first half of the 1980s from 32.7 to 30.1 per cent. During the following five years, however, their production grew by 5 per cent per year, which enabled them to expand their share to 35.6 per cent in 1990-1992. These developments were mainly due to the crisis and restructuring undergone by the copper industry of the United States (see section A above). Because of this, the share of the United States in 1990-1992, 18.2 per cent, was even higher than at the beginning of the decade (16 per cent). Another important development among developed countries occurred in Portugal, where the Neves-Corvo mine (170 ktpy Cu capacity) was commissioned in 1988.

97. The countries of Eastern Europe maintained their market share during the 1980-1985 period, as their production increased on a par with the world trend. However, at the end of the decade (particularly in 1989-1991), copper output decreased in absolute terms in the two main producing countries of the group, the former USSR and Poland. This was caused by the disintegration of economic structures that marked the beginning of the transition from centrally planned economies to market economies. From 1985-1987 to 1990-1992 Eastern Europe's mine copper production decreased by 4.2 per cent per year and consequently the region's share shrank from 18.6 to 14 per cent.[50] However, this did not prevent the CIS from keeping the position of the world's third largest copper mine producer previously held by the former USSR.

98. China increased its mine copper production at an annual rate of 7.2 per cent during the 1980s, as a partial answer to its rapidly growing demand for the metal (see chapter I). Consequently, its rank among copper producing countries rose from the 13th to the eighth position. During the same period, the production of Mongolia increased by 6.2 per cent annually.

99. According to the projections of the geographical distribution of copper mine capacity presented in table 23, the market shares of both Africa and North America should decrease slightly in the coming ten years, whereas that of Asia should increase to a limited extent. The largest expansion in capacity and hence in production should originate in South America, mainly Chile. This country has the largest known copper reserves (28.6 per cent of the world total - chart 5), and big projects (new mines and capacity expansions) are being implemented, which are likely to further increase its market share in the coming years.

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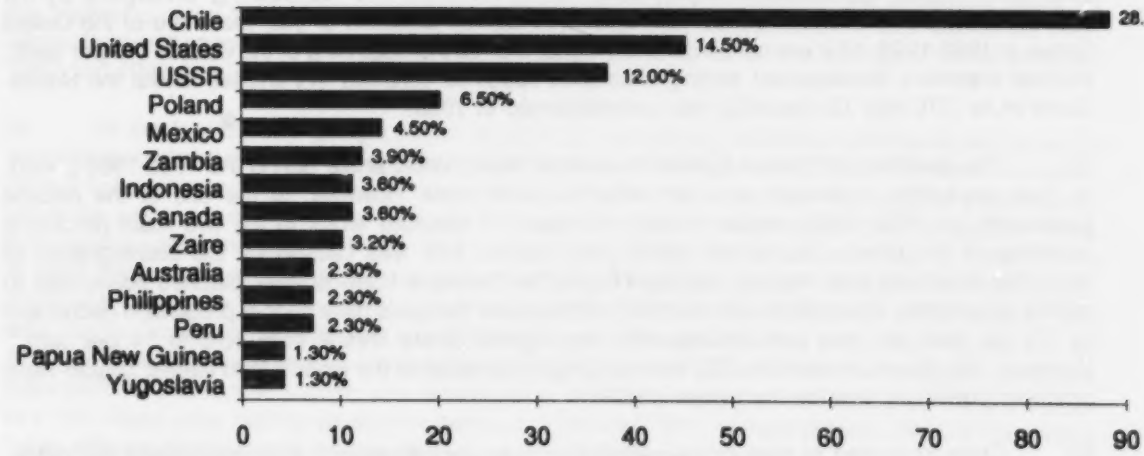
[50] These data do not include the former East Germany.

100. The republics of the former USSR possess the third largest copper reserves of the world, after Chile and the United States. However, they exploit them at a slower rate than the other two countries and thus have a potential for significant expansions in production. However, the future of CIS copper production (concentrated mainly in Russia and Kazakhstan, which account for 53 per cent and 32 per cent of the CIS total, respectively) will be determined by the evolution of the overall economic situation of the CIS and by the restructuring of its copper industry. Thus it could take several years before the region is able to increase its mine output significantly.

101. UNCTAD projections based on closures, expansions and new projects foreseen at present (see paragraph 39 above) show that Western mine copper production capacity is expected to grow at an annual rate of 2.6 per cent during the present decade (chart 6).[51] This presupposes an acceleration in the pace of capacity expansion as compared to the 1980s (when it grew at an annual rate of 1.8 per cent), which is justified by the forecasts of a strong increase in demand in the coming years (see chapter I). The USBM forecasts an annual expansion rate of 2.76 per cent in world mine capacity between 1993 and 1997 (table 23), though it foresees a slowdown in capacity expansion thereafter.

Chart 5

Copper reserves in 1991
(million tons Cu and % of world total)

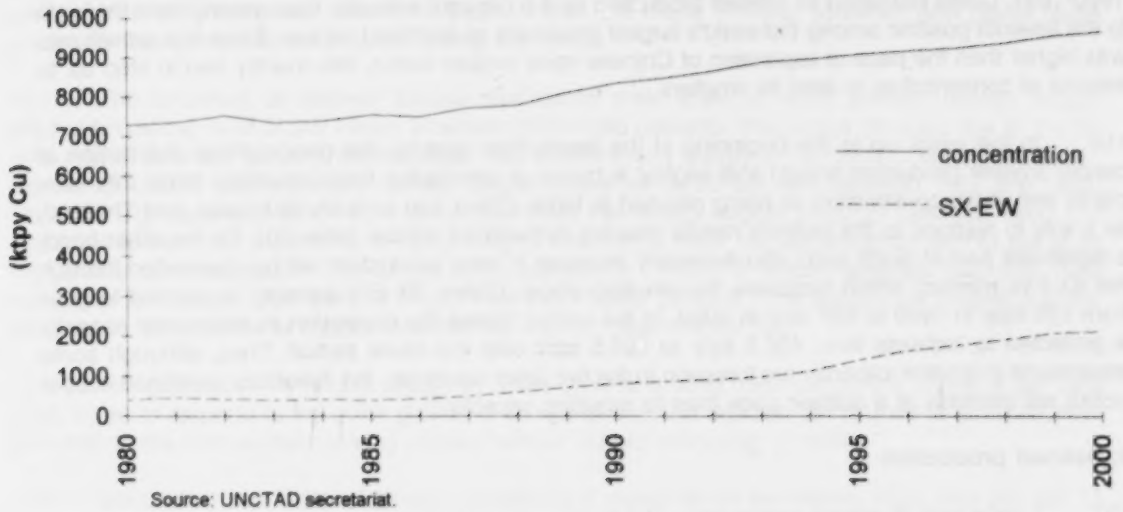


Source: USBM, Minerals Yearbook 1991.

[51] A summary of major changes to production capacity for Western copper mines over the 1993-1997 period is presented in table 29.

Chart 6

Western mine copper production capacity by ore processing method, 1980-2000



Source: UNCTAD secretariat.

2. Unrefined production

102. At the beginning of the 1990s, developed and developing countries controlled a roughly equal share of unrefined[52] copper production (table 24). The downturn in the production of the United States and Japan caused developed countries' total unrefined copper output to decline until the middle of the last decade. By 1990-1991, however, their share in world unrefined production was close to that of 1980-1982. Three developed countries were among the world's five largest producers in 1990-1991: United States (second), Japan (third) and Canada (fifth) (table 25).

103. The share of developing countries rose from 35.2 to 38.8 per cent between the beginning of the 1980s and of the 1990s, since the growth in output in developing America and Asia more than compensated for the decline of Africa's production. Chile, accounting for 68 per cent of Latin America's unrefined production, increased its output by 3.1 per cent per year over that period. Capacity expansions of smelters already existing in 1980 and the tripling of its SX-EW capacity between 1980 and 1992 were responsible for that evolution. Consequently, it became the world's largest producer of unrefined copper. Mexican production rose by 145 per cent over the period, through the commissioning of two new smelters (La Caridad and Pasteje, with a total capacity of 200 ktpy) and the expansion of a third. Developing Asia increased its share in world unrefined production from 2.3 to 5.9 per cent with the commissioning of new smelters in the Philippines (Pasar in 1983) and the Islamic Republic of Iran (Sar Chesmeh in 1982) and with capacity expansions in the Republic of Korea.

104. Zambia and Zaire account for 92 per cent of developing Africa's unrefined copper output. Their production at this stage of processing declined in absolute terms during the 1980s, in line with the downward trend of mine production mentioned earlier. As a result, Zambia moved from the fifth to the sixth position among the world's largest producers. Zaire, which at the beginning of the period had been the sixth largest producer, became the ninth.

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[52] The statistics of unrefined production used in the following paragraphs and in tables 24 and 25 include smelter production from concentrates and the output of SX-EW plants.

105. Eastern Europe's share in world unrefined copper output remained approximately constant during the first half of the 1980s but contracted at the end of the decade and at the beginning of the 1990s on a par with the downward trend of mine production. Consequently, the former USSR, which in 1980-1982 had been the largest producer of unrefined copper, dropped to the fourth position by 1990-1991. China increased its smelter production by 8.5 per cent annually, thus moving from the tenth to the seventh position among the world's largest producers of unrefined copper. Since this growth rate was higher than the pace of expansion of Chinese mine copper output, the country had to step up its imports of concentrates to feed its smelters.

106. In the years up to the beginning of the twenty-first century, the geographical distribution of copper smelter production should shift slightly in favour of developing Asian countries (table 28). New plants are under construction or being planned in India, China and possibly Indonesia and Thailand, as a way to respond to the region's rapidly growing demand for copper (table 30). On the other hand, a significant part of North and Latin America's increase in mine production will be channelled through the SX-EW method, which bypasses the smelting stage. Chile's SX-EW capacity is planned to grow from 135 ktpy in 1990 to 885 ktpy in 2000. In the United States the expansion in electrowon capacity is projected to increase from 450.5 ktpy to 605.5 ktpy over the same period. Thus, although some expansions in smelter capacity are foreseen in the two latter countries, the Americas' unrefined copper output will increase at a quicker pace than its smelting capacity.[53]

3. Refined production

107. Total supply of refined copper grew at 1.3 per cent p.a. between 1980 and 1992 (the same rate as that of consumption expansion), surpassing 10 million tons in 1987 (tables 26 and 27). As in the case of consumption, the pace of growth of refined production in the 1980s was much slower than in the 1970s (2.1 per cent p.a.) and that of the 1960s (4.1 per cent p.a.).

108. World production of **primary** refined copper has traditionally been more concentrated in the main consuming countries than the mining and unrefined stages of processing of the metal. This explains why some countries like Japan, Germany and Belgium are among the leading producers of refined copper although they do not have any significant mining capacity. The same rationale applies to some relatively industrialized developing countries like the Republic of Korea and Brazil. Their refining capacities largely exceed their mining production.

109. In 1990-1992 developed countries (the main consumers) controlled 45.1 per cent of world refined output, as opposed to 40.4 per cent of unrefined production and 35.6 per cent in the case of ore.[54] The largest primary refined copper producer has traditionally been the United States, except in 1980-1987. During these years, as a result of the retrenchment of the American copper industry, the country lost the position of largest primary refined copper producer to the USSR. From 1988 onwards, however, the United States again became the leading producer, accounting for 17.7 per cent of world output in the early 1990s. Among developed countries, another relevant development between 1980 and 1992 was the fall in Belgian production by 5.4 per cent p.a., which brought the country down from the seventh to the eleventh position among the world's largest producers of refined copper.

110. Among developing countries primary refined copper production had a similar evolution to that of mine output: Latin America and, to a lesser extent, Asia increased their market shares while that of Africa fell. In the first case, the main responsibility for this development lay with Chile, where output expanded at a rate similar to that of the growth of mine production (4.2 per cent p.a.). This enabled the country to increase its share in world supply from 10 per cent to 13.4 per cent, becoming the world's second largest producer. Regarding Africa, refined copper output in Zambia declined steadily over the

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[53] Considering SX-EW output as unrefined production, as in tables 24 to 27.

[54] This is still a much lower degree of concentration than that of consumption (see chapter I).

1980s at an annual rate of 3.3 per cent. Zaire's production grew strongly until the middle of the decade, but after 1988 it fell to a level below that of the beginning of the 1980s. In both countries refined copper production was negatively affected by the same factors that led to the fall in mine output (see section A above). Among other developing countries, there were significant increases in primary refined production in the Philippines, Islamic Republic of Iran and Brazil. In these countries new plants came on stream alongside smelter projects during the 1980s.

111. The countries of Eastern Europe maintained their share in world primary refined copper production during most of the 1980s. However, from 1988 onwards, their share dropped due to the fall of output in absolute terms. This decrease was concentrated mainly in the group's largest producer, the former USSR, where primary refined copper output fell by 22 per cent between 1987 and 1992. Thus the CIS republics, which as a group had been the world's largest producer between 1980 and 1987, fell to the third position at the beginning of the 1990s. Their output, however, did not fall at as high a rate as consumption. The 22 per cent reduction in USSR/CIS output between 1987 and 1992 compares to a much larger drop of 37 per cent in domestic demand. This divergence caused a sharp increase in the quantity of copper available for exports (see chapter IV).

112. The production of refined copper in China grew at a rapid pace during the 1980s (6 per cent p.a.), so as to respond to the quick growth of consumption. This enabled the country to advance from the ninth to the fifth position among primary refined copper producing countries.

113. **Secondary** raw material (scrap) maintained a steady share as refinery input over the last 12 years. It accounted then for approximately 15 per cent of total world refined copper production (or around 19 per cent, excluding the countries of Eastern Europe and China).[55] The degree of concentration of secondary refined production in consuming countries is still higher than that of primary refined output. This is because secondary refined production depends on the availability of scrap, which in turn is determined by the volume of past copper consumption. Developed countries have historically accounted for the largest part of world copper consumption (73-76 per cent of the world total until the early 1970s and around 65 per cent throughout the 1980s) . Consequently, they dispose of the largest stocks of recyclable secondary material. Secondary production has traditionally been concentrated in the largest consuming countries and the bulk of international trade in copper scrap is also carried on among developed countries.

114. The United States is by far the most important producing country of secondary refined copper, though its share in world output has been falling continuously since the early 1960s. This trend continued throughout the 1980s, when the share of the United States dropped from 35.6 to 26.6 per cent. This was due to the sharp contraction of secondary production at the beginning of the 1980s (on a par with the reduction of overall activity in the American copper industry), which was only partially compensated by the growth that started in 1985. The level of secondary refined production in 1990-1992 was 9.1 per cent lower than in 1980-1982, which compares to a growth of 22.1 per cent in primary production. The importance of scrap as refinery input was reduced from 26.3 per cent to 21 per cent over the same period.

115. In Western Europe refined copper production followed the opposite path to that of the United States. Its secondary refined copper production grew by 3.8 per cent p.a. between 1980 and 1992, while primary output fell at an annual rate of 0.9 per cent p.a.. Consequently, the share of scrap in total input of Western European refineries grew over the period from 36.3 to 47.6 per cent and the region became the world's largest consumer of copper scrap. Production from scrap grew by 5.3 per cent p.a. in Germany and by 16.4 per cent p.a. in Italy over that period. Consequently, these countries became, respectively, the second (displacing Japan) and the fifth largest producer of secondary copper. The importance of secondary feedstock to refineries in Germany increased from 47.1 to 57.5 per cent of

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[55] Statistics for secondary refined production are not available for the countries of Eastern Europe and China.

total refined production and from 16.2 to 33.2 per cent in Belgium. In the latter country national secondary refined production expanded by 4 per cent p.a. over that period, while primary production decreased in absolute terms.

116. Another important development in the production of secondary refined copper during the 1980s was the growth in output in some developing countries like Mexico and the Republic of Korea.

117. Future regional distribution of refined copper production will probably follow the direction of copper consumption, since historically refined production has tended to be located closer to final consumers rather than to primary producers. Thus, refined production should increase at a quicker pace in regions where copper demand is growing rapidly, mainly South East and South Asia and China. New refineries and/or capacity expansions are under construction or being planned in these regions (table 31). Thus, the share of Asia in Western refinery capacity is projected to grow from 19.3 to 22.5 per cent between 1990 and 2000. Over the same period, the combined share of North America and Western Europe should fall from 47 to 43.4 per cent (table 28). North America should, however, remain as the region with the largest refining capacity. At the same time, the shares of Latin America and Africa should remain constant.

118. A different method of assessing refined copper production capacity is to add SX-EW capacity to refinery capacity. Indeed, the fact that the degree of purity of SX-EW production increased over recent years allows semimanufacturers to use SX-EW cathodes without any further refining.[56] When total refined production capacity is considered according to this method, the regional distribution is different from that of refineries. SX-EW plants are located at the mining sites in producing countries, which is not generally true of refineries, as mentioned above. The share of total refined production capacity in Latin America is expected to grow from 20.7 to 26.9 per cent of the Western total, largely owing to the increase of SX-EW plants in Chile. The region would thus become the one with the largest refining capacity, but with a share similar to that of North America. Asia's total refining capacity would increase from 17.8 to 19.1 per cent of the Western total, while the combined share of North America and Western Europe would fall from 47.8 to 41.1 per cent.

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[56] However, in the statistics presented in tables 24 to 27, SX-EW output is included in unrefined production data, as mentioned before.

III. TECHNOLOGICAL AND ENVIRONMENTAL ISSUES

119. The main technological innovations in the production of unwrought copper over the last 20 years were:

- the introduction of flash and continuous processes in smelting (mainly the Outokumpu, Inco, Noranda and Mitsubishi models), which have largely replaced the reverberatory smelters (80 per cent of greenfield smelters in the 1990s use the new technology). Flash smelting increases recovery rates and reduces emission levels;
- the expansion of electro-refining at the expense of fire-refining. The first process yields a higher purity cathode (99.95 per cent Cu, as compared to 99.6 per cent Cu in the second case) and thus responds better to increasing purity requirements;
- the application of the solvent extraction-electrowinning (SX-EW) process to oxide ore leached by acid, which allows the production of high-purity cathodes at the mining site (as opposed to copper cement produced by simple leaching) and bypasses the smelter-refinery stage;
- bio-leaching, which accelerates the leaching reaction of sulphides through the action of bacteria, as compared to acid leaching (although it is still slower than the acid leaching of oxides).

120. These developments either were specific to copper production or had a stronger impact on it than on other metals. In addition, copper production was affected by technological changes that also applied to other metals, like the use of larger scale equipment, increased use of in-pit crushers and conveyors, more widespread adoption of column flotation and increase of the degree of automation.

121. Of the innovations mentioned above, the development of the leaching-SX-EW route has had the strongest impact on copper production to date. By processing the ore at the mining site, it eliminates the need to transport concentrates to smelters and increases value added at the site itself. It makes for considerable cost reductions and a lower investment cost and consequently reduces the minimum scale for operations to be economical. Whereas SX-EW plants with a capacity even lower than 5 ktpy can be profitable, a greenfield smelter must have a capacity of at least 100 ktpy to be viable. That is also the minimum scale for a new refinery, though ideally it should be still larger. Since SX-EW allows for great scale flexibility, the size of operations can vary considerably. The largest plant presently projected is El Abra (Chile), set to reach a capacity of 225 ktpy.

122. The new technique enables considerably lower grade ore to be recovered than by the conventional method and therefore can be used not only in orebodies being mined for the first time but also in tailings of mines that formerly processed their ore through the traditional route. Thus, the life of a mine may be extended after metal has been extracted from higher grade ore. In some cases there is a combination of both methods: concentrates are produced through the conventional method and the tailings are submitted to leaching and SX-EW. The remaining material after the first extraction of metal through leaching can be dumped to start the process again (i.e., extract the remaining metal content).

123. SX-EW production capacity increased at a much higher rate during the 1980s than the capacity of mines that have their ore processed through concentration, smelting and refining. Whereas the latter grew by 1.4 per cent p.a. between 1980 and 1990 in the West, SX-EW capacity increased by 7 per cent p.a. over the same period. In the following ten years, the growth rates should stabilize at 1.5 per cent in the first case and accelerate to 10.1 per cent in the second (chart 6). Consequently the share of that technology in total Western primary copper producing capacity (which comprises both methods) grew from 5.4 per cent in 1980 to 8.9 per cent in 1990. By the end of the century it should reach 18.1 per cent. Worldwide, the proportion of mine production following the SX-EW route is projected to increase from 10.5 per cent in 1993 to 13.8 per cent in 1997 but shrink to 11.9 per cent by 2005 (table 23). This reflects the fact that most of the world SX-EW capacity is concentrated in a few Western countries.

124. The increase in SX-EW production in the last 15 years was concentrated basically in the United

States and Chile. In 1990, these two countries accounted for 55.1 and 16.5 per cent, respectively, of Western SX-EW capacity. In the coming years, mine capacity using this technology is expected to increase at a quicker rate in Chile. By 2000 the country will account for 53 per cent of Western SX-EW capacity. Until then, large projects like Codelco's El Abra and Radomiro Tomic and private ones (e.g., Zaldívar, Quebrada Blanca and possibly La Escondida) are scheduled to be commissioned. Over the same period, the share of the United States in Western SX-EW capacity would fall from 55.1 to 28.5 per cent.

125. The main limitation to the further geographical expansion of SX-EW production is the geological composition of ore. The new process is more suitable to the processing of oxides than to that of sulphides and complex ores. Most of the world copper production comes from sulphide ore rather than from oxides. The development of bio-leaching techniques might change this, by making it economically feasible to process sulphides and mixed ore also through the hydrometallurgical process. Another restriction is climate. Most SX-EW plants to date have been built in dry regions, because high humidity or heavy rainfalls would greatly decrease the efficiency of the process.

126. The main consequences of the introduction of SX-EW have been: lower investment costs; higher recovery rates; lower unit production costs; reduction of minimum operation scales; higher labour productivity; recovery of lower grade ore; and reduction of environmentally hazardous emissions. As for the smelting and refining technologies mentioned, their main features are improved recovery of metal, higher productivity and reduction of hazardous emissions.

What is SX-EW?

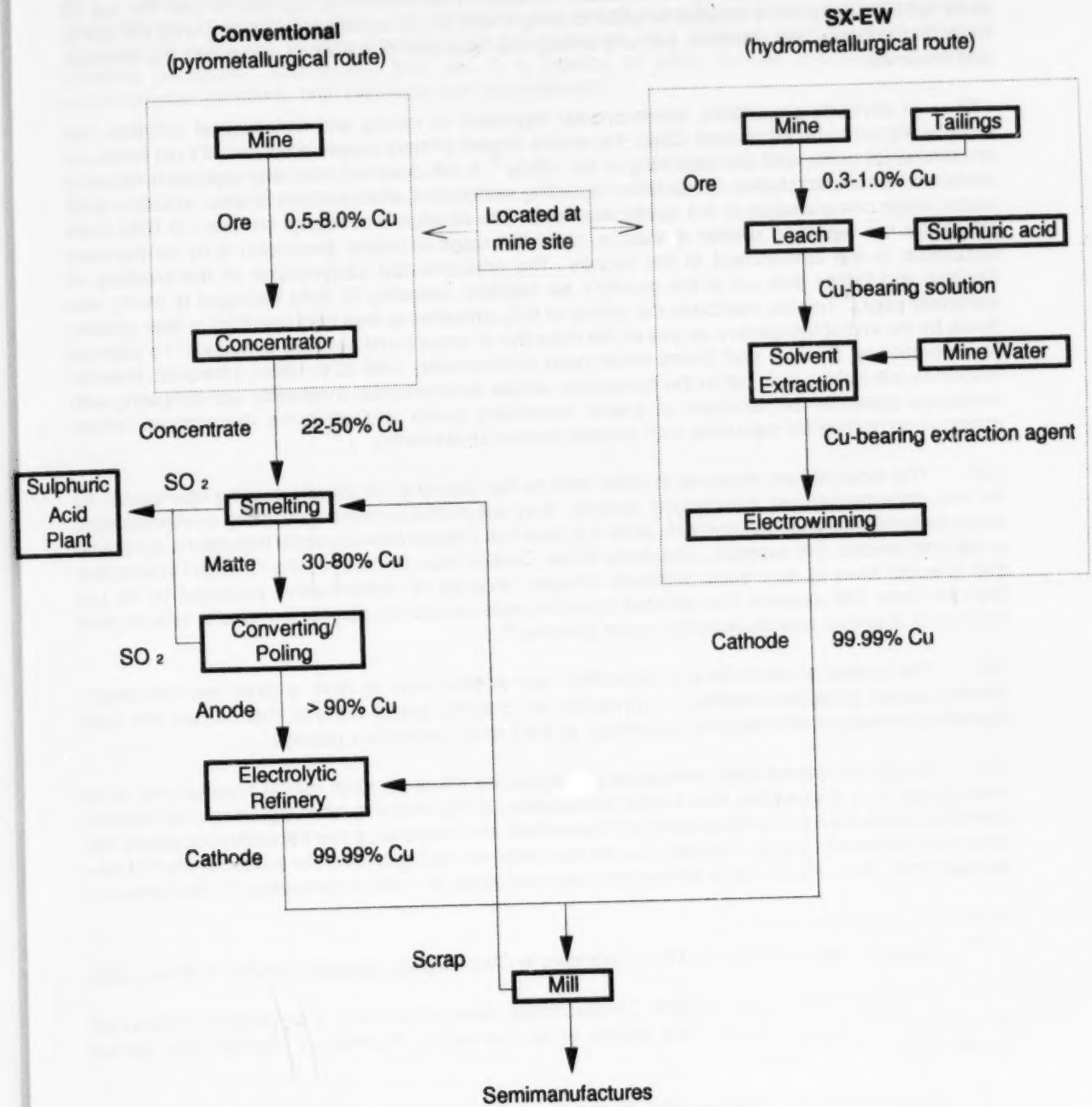
The first phase of this production technology is the acid and/or bacteriological leaching of ore in dumps, heaps or *in situ*. The leaching solution is percolated through copper-containing ore, thereby dissolving the metal and incorporating it to form copper sulphate (leachate). This copper-containing leaching solution is collected and pumped into solvent extraction tanks, where the metal is removed by mixing the leachate with organic extractant. The copper-rich extractant is then mixed with electrolyte and the solution is pumped into an electrowinning plant. Here it is submitted to electrical current, which causes copper to accumulate on a copper cathode (see Chart 7).

The leaching phase has already been used for the processing of oxide ores for a long time. However, this process by itself produces cement copper, which contains just about 30 per cent of copper and thus has to be submitted to smelting and refining (the pyrometallurgical route). The SX-EW technology (constituting the hydrometallurgical route) was rapidly developed and improved during the 1970s and 1980s and now enables high-grade cathodes to be produced. Some plants produce cathodes that meet LME purity requirements and therefore their output has been registered by that Exchange. SX-EW cathodes have a lower content of elements such as arsenic, antimony, bismuth, selenium and tellurium than cathodes produced in electrolytic refineries. They have a higher ductility and are thus largely used by wire fabricators.

127. One factor that led to the adoption of newer technologies was in fact the need to comply with more stringent environmental regulations. Since the 1970s mining and metallurgical companies in developed countries have been facing increasing regulation to reduce the negative environmental impact of their production activities: air and water contamination from mining operations; reclamation of mining sites and tailings deposits; air contamination produced by sulphur and particle emissions (including arsenic) produced by smelters. The cost of compliance with stricter environmental regulations is more easily absorbed by new projects than by plants already in operation. The former incorporate "cleaner" technologies and working methods from the start, whereas the latter have high sunken costs in existing facilities.

Chart 7

Conventional and SX-EW copper production



Sources: based on Billiton-Enthoven Metals, op. cit., and Metallgesellschaft, op. cit..

128. The United States authorities, for instance, pressed copper companies from the second half of the 1970s onwards to reduce emissions from their smelters. However, this entailed high initial investment costs at a time when companies were in a bad financial situation due to the prolonged market downturn. This led some companies to close down their smelters. Others built sulphuric acid plants (to fix the sulphur contained in copper ores) and/or changed from reverberatory to flash smelting. In other developed countries, the considerable increase of environmental regulations over the last 20 years led their companies to adapt in order to comply with these regulations. Consequently the plants located in industrialized countries are now among the "cleanest" of the world, especially the smelters and refineries.

129. In developing countries, environmental regulation of mining and metallurgical activities has recently started to be introduced. Chile, the world's largest primary copper producer, did not have any environmental policy until the beginning of the 1990s.[57] It still does not have any legislation requiring environmental impact studies or regulation regarding reclamation, abandonment of sites, industrial solid waste, water contamination or soil quality standards. The situation is changing, however. In 1992 Chile adopted a law regarding smelter emissions, since this stage of copper production is by far the most hazardous to the environment in the country. The environmental performance of the smelters of Codelco and Enami (five out of the country's six smelters operating in 1992 belonged to them) was extremely poor.[58] The law mandates the cutting of SO_2 emissions to less than one third of their present levels by the end of the century as well as the reduction of arsenic and particles emissions. To upgrade their operations, Codelco and Enami would need approximately US$ 920 million. However, financial resources are lacking both within the companies (where environmental constraints are competing with expansion plans for the allocation of scarce investment funds) and within the Government (where mining is competing for resources with socially needed investments).

130. The most difficult problems in Chile refer to the "cleaning" of already existing operations. As for new large mining and metallurgical projects, they will probably incorporate more environmentally sound technologies and management, since it is clear that Chilean environmental regulations are bound to become stricter. For example, Disputada de las Condes was informed by the Chilean Government that it would have to pay water treatment charges because of contamination produced by its Los Bronces mine. The company then decided to build a bacterial leaching plant at the mine to recycle mine and dump drainage, thereby reducing water pollution.[59]

131. The spread of leach-SX-EW production was another way to have a more environmentally friendly copper production method. it bypasses the smelting stage, the one that causes the most hazardous emissions into the air of all phases of the metal's production process.

132. Usually compliance with environmental regulations demands large capital expenditures in the initial phase. This is especially true if what is in question is the environmental upgrading of an existing operation, rather than the commissioning of a greenfield one. However, it has frequently happened that more environmentally friendly technologies are also better technologies from the economic point of view because they bring about higher productivity and reductions in costs of production.[60] The spread of

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[57] Gustavo Lagos, *Mining and the environment in Chile*, Golden, Colorado School of Mines, 1992.

[58] In 1992, Chile's largest smelter, Chuquicamata, fixed 45 per cent of the sulphur it produced, as compared to virtually 100 per cent sulphur to be captured by Kennecott's planned new Garfield smelter (Utah, United States).

[59] Alyson Warhurst, "Environmental management in mining and mineral processing in developing countries", *Resources Policy*, February 1992.

[60] "After a period of using rather static technology, the mining and mineral processing industry is going through a phase of technical change as dynamic companies are innovating to escape economic as well as environmental constraints. Rapidly evolving environmental regulatory frameworks

SX-EW production and the conversion of smelters to flash furnaces are examples in which new technologies imply reduced hazardous emissions but also lower production costs and higher recovery rates.

133. Some of these technologies have become a competitive advantage for the companies that have taken the lead in developing them. The companies can pay off at least part of their investment cost by licensing the technology to other producers, as do Outokumpu, Inco, Noranda and Mitsubishi with their smelting processes. Additionally, they are in a position to lobby for the imposition of stricter environmental standards both nationally and internationally.

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in the developed countries and the prospects of their application, along with credit conditionality in the developing countries, are reinforcing this trend." (Warhurst, *op. cit.*, p. 46).

IV. INTERNATIONAL TRADE

134. Contrary to the trend of world copper consumption and production, which in the 1980s grew at a much lower rate than during previous decades, world trade in unwrought copper expanded between 1980-1982 and 1990-1992 at the same rate as in the 1970s (2.6 per cent p.a. in terms of volume). This is just slightly slower than the pace achieved in the 1960s (3 per cent p.a.). There was, however, a change in the composition of the unwrought copper trade, since the importance of concentrates grew at the expense of unrefined metal (see below). The exports of developing countries followed the same trends as total world exports, i.e., exports of concentrates grew while those of blister decreased in absolute terms.

135. In the early 1970s Chile became the largest exporter of unwrought copper, replacing Zambia. Its lead over other exporters has increased ever since and the country now accounts for one fourth of world exports (tables 32 and 33). Chilean exports are mostly made up of refined metal (two thirds) and concentrates (almost a third). The combined share in world exports of Zambia and Zaire, which until the early 1970s had been around 26 per cent, was halved during the 1980s. It fell from 20.3 per cent in 1980-1982 to 9.9 per cent in 1990-1992, on a par with the drop in production in these countries (see chapter II). Zambia makes virtually all of its unwrought copper exports in refined form, while Zaire is the only major exporter that sells copper abroad predominantly in unrefined form.

136. In the mid-1960s Japan became the largest unwrought copper importing country, a position it has kept ever since, accounting at present for more than one fifth of total imports. Most of the other large importers have traditionally been Western European countries, mainly Germany, Belgium, France, Italy and the United Kingdom. The three latter import almost all unwrought copper in the form of refined metal. Germany and Belgium also import concentrates and unrefined copper besides refined metal, since they have large primary processing plants (tables 34 and 35). The main change occurring on the importing side over the last 15 years was the emergence of Taiwan, Province of China, and the Republic of Korea. Whereas they had been minor importers until the mid-1970s, they became, respectively, the fifth and sixth largest importing countries in the early 1990s, prompted by the rapid growth in their copper demand (see chapter I).

A. Copper ore

137. International trade in concentrates expanded quickly since the early 1960s. The production of mines was traded with smelting/refining companies that did not have ownership relations with the mine producer. Expansion of this trade was basically a consequence of the policy adopted by large importing countries (especially Japan and, to a lesser extent, Germany and the Republic of Korea). It led to the building in these countries of domestic smelting and refining capacity for which the raw material would be supplied by imports of concentrates. In the early 1960s, ore made up just 9.2 per cent of international trade in unwrought copper, with refined metal accounting for approximately two thirds and blister for the balance. By 1980-1982, the share of concentrates in total trade had grown to 27.7 per cent and it increased further to 32.8 per cent ten years later. As a consequence of the expansion of the concentrates market, around one fourth of world mine production now enters international trade in concentrate form. This compares to 18.1 per cent ten years ago and just 6.3 per cent in the early 1960s.

138. During the 1980s, the expansion of the concentrates trade was caused by the commissioning of several mines in countries that do not yet possess smelters and refineries (like Indonesia and Portugal) or whose mine output largely exceeded their smelting capacity (e.g., Chile and Sweden). On the importing side, the growing concentrates trade was directed to countries whose smelting capacity was larger than their mining capacities because of smelter expansions or mine depletion, like Philippines, Brazil, China and Finland.

139. The three largest exporting countries of copper concentrates[61] at the beginning of the 1990s (Chile, Canada and United States) were among the world's four largest mine producers. They have large smelting and refining capacities that are exceeded, however, by their mining capacities (tables 36 and 37). Mine capacity in Chile grew throughout the 1980s at a slightly higher rate than its smelting capacity. In the second half of the decade, most new mine projects came from the private sector in plants not integrated with smelters and refineries. Consequently, the increased availability of concentrates went to foreign markets and the country's exports expanded at an annual rate of 12 per cent. This made Chile jump from the fifth to the first position among the world's largest exporters of ores and concentrates, displacing Canada. Exports of the latter country expanded between 1983 and 1990 but fell in 1991 and 1992. Consequently, Canada's share in total world concentrates exports dropped from 20 to 16 per cent between the early 1980s and the beginning of the 1990s. The largest export market for both countries is Japan, but it is relatively much more important for Canada than for Chile. Japan purchases 70 per cent of Canadian concentrates exports, but just one third of those of Chile. Chilean concentrates are exported to a wide range of countries, mostly in Asia and Europe.

140. Until 1979, the United States had been a net importer of copper ore, processing domestically almost all the ore produced in the country and importing minor quantities of concentrates. In 1979, however, it became a net exporter of concentrates, a shift that was accentuated during the 1980s. Initially, the contraction of domestic consumption and the reduction in smelting capacity increased the availability of concentrates for export. Subsequently, the restructuring process of the American copper industry enabled it to increase mine production at a quicker rate than its smelting capacity, which allowed the country to increase its net ore exports. Consequently, concentrates averaged 73.6 per cent of United States exports of unwrought copper during the 1980s, whereas during the preceding decade they accounted for just 14.4 per cent of total exports of the metal. By the early 1990s the United States had become the third largest concentrates-exporting country, while being at the same time the third largest ore importer.

141. During the second half of the 1980s the exports of concentrates and of refined copper from the United States received a boost from the real depreciation of the US dollar. This led to the sharp reduction of the United States net imports of unwrought metal (chart 8), to the point that in 1991 the country had a surplus in its unmanufactured copper trade.

142. The fourth to seventh largest concentrates exporters in 1990-1992 were Indonesia, Portugal, Papua New Guinea and Mongolia. These countries increased their mine production in the 1980s either through mine expansions or through the commissioning of large mines but do not have domestic smelting capacity. The building of a smelter was at one point, or is still, being considered by these countries.

143. The Philippines, which in 1980-1982 was the largest exporter of copper concentrates, reduced its exports by more than half from 1983 onwards (when the Pasar smelter came on stream) and thus fell to the eighth position among the largest exporters. A similar phenomenon occurred in the case of Mexico, whose ore exports fell by 4 per cent p.a., as the country expanded its smelting capacity and thus increased its exports in blister form.

144. The other large copper mine producers (the former USSR, Zambia, Poland and China) possess smelting and refining capacities that allow them to process their concentrates output domestically and therefore are not significant ore exporters.

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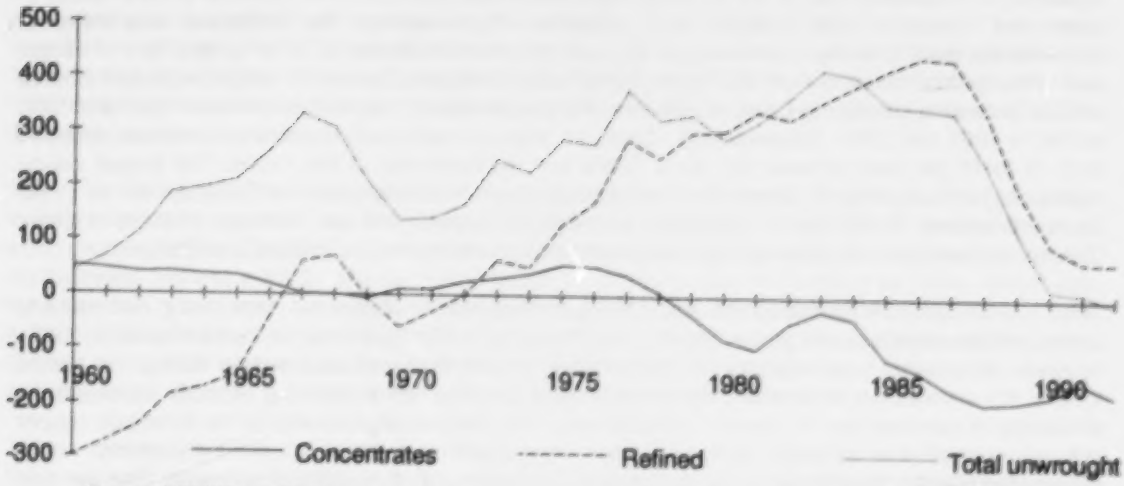
[61] Available trade data include ore, matte and cement, but reference is made to the aggregate as "concentrates", which account for 97 per cent of this trade classification.

Chart 8

United States net imports of unwrought copper, 1960-1992
(three-year moving average, ktpy Cu)



Source: UNCTAD secretariat.

* concentrates + unrefined + refined copper

145. Japan is by far the largest importer of concentrates, accounting for almost half the world total (tables 38 and 39). Consequently, it is the largest market for the major ore exporting countries, except for Mongolia, Mexico and Portugal (tables 40 and 41).[62] Almost all Japanese imports of copper concentrates come from countries around the Pacific Rim, particularly Canada, Chile, Indonesia and the Philippines. Japan has a large smelting and refining capacity but negligible mine production. It guarantees the supply of its smelters through long-term contracts with mining companies abroad. The mine producers frequently have long-standing ties with Japanese institutions because the latter have played a role as lenders or as direct investors in mining projects. This was part of a Japanese policy to undertake most of the processing of copper inside the country rather than importing the refined metal. Consequently, Japan has a nominal copper refining capacity that roughly matches its consumption of the metal. More than two thirds of its total imports of unwrought copper are made in the form of concentrates. As part of this policy, the Japanese Government imposes an import tax on refined copper (whereas there is no tariff on ore imports). It partially protects the domestic metallurgical industry from foreign competition. At the end of the last decade, however, Japanese refining capacity decreased marginally with the decommissioning of two refineries. Therefore, imports of refined copper had to increase to meet the growing domestic demand. But between 1991 and 1994 the country's refining capacity should grow again, given the expansions under way.

146. The second largest ore importer is Germany, which, like Japan has a large smelting and refining capacity and maintains long-term contracts with foreign mining companies. However, unlike Japan, Germany purchases abroad just 19 per cent of its unwrought copper as concentrates. Seventy-four per cent of its imports consist of refined metal. This has to be imported to bridge the gap between domestic consumption and the country's refining capacity (which corresponds to about 65 per cent of the domestic demand for refined copper). Like Spain, the other large West European concentrates importer, Germany currently imports most of its concentrates from Chile and Portugal.

147. Among developing countries, Brazil did not import copper ore until 1982, relying on foreign supplies for its refined copper consumption. From that year onwards, however, the country started to

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[62] The largest importers of concentrates from Mongolia, Mexico and Portugal are the CIS, the United States and Germany, respectively.

import concentrates (now at the level of about 100 ktpy Cu), thus becoming the world's fifth largest ore importer. The purpose of these imports is to complement domestic supplies for the Camaçari smelter-refinery complex (commissioned at the end of 1982), since, at present, domestic mining capacity corresponds to less than half of the country's processing capacity. The Republic of Korea maintained the volume of its imports constant during the decade. Consequently, it fell from the third to the eighth position among the largest importers. Taiwan, Province of China, virtually ceased purchasing concentrates abroad, since its only large smelter, Keelung, closed in 1990.

148. In the coming years, trade in ores and concentrates is likely to grow because smelting and refining capacity will be established or expanded in countries that do not have the corresponding mining capacity, like China, India and Thailand (tables 30 and 31).

B. Unrefined copper

149. Unrefined copper exports have been declining in relation to total trade since the early 1960s. During the 1970s and most of the 1980s the volume of blister trade remained roughly constant, while that of concentrates and refined metal grew. This was due basically to the fact that some large developing country exporters expanded the processing of copper and thus increased their exports of refined copper. Furthermore, most of the smelters that were commissioned by them during that period were part of integrated complexes comprising refineries (with some few exceptions). From 1987 on blister trade fell in absolute terms, largely because of the drop in the exports of Zaire, the largest exporter (table 42). Consequently, the share of unrefined copper in total unwrought trade fell from 14.2 per cent in the early 1980s to 8.5 per cent ten years later.

150. Since the early 1970s the largest exporter at this stage of processing has been Zaire (table 43). The country has a smelting capacity that exceeds its mining capacity but its refining capacity corresponds to approximately half its smelting capacity. Thus a significant portion of its unrefined copper production is exported, mainly to Belgium. The latter is consequently the largest importer of blister copper, accounting for approximately one third of world total imports (tables 44 and 45).

151. The second largest unrefined copper exporter, Chile, sells abroad a marginal part of its mine output as blister (6 per cent). Peru, the third largest, exports about one fourth of its mine production in the form of unrefined copper. This is due to the fact that its refining capacity is insufficient to process all of its smelter output. Mexico upgraded its copper exports from ores to blister during the last decade, expanding its unrefined exports by 27 per cent p.a.. This raised the country to the fourth position among the largest exporters of unrefined copper in the early 1990s. Exported unrefined copper corresponded to one quarter of the country's mine output in 1990-1992, while ten years earlier this proportion had been just 3.2 per cent. This is explained by the coming on stream of two new smelters and the expansion of a third without the corresponding refining capacity. Although the increase of the country's refining capacity and the commissioning of new plants were planned, the implementation was postponed for several years and is still being undertaken. The fifth largest exporter is Namibia, where copper operations are integrated only up to the level of smelting. Therefore, blister exports attain the same volume as that of national mine production.

152. The ten largest blister importers are countries whose refining capacity is larger than their smelting capacity (except China and Japan). Most of them are developed countries (with the exception of China, the Republic of Korea and Turkey).

C. Refined copper

153. The bulk of international trade in unwrought copper, approximately 60 per cent, is carried out in refined metal. The share of world refined production that enters international trade is not very high: approximately one third. This reflects the historical tendency for a larger part of the refined production capacity to be located in consuming countries rather than in producing regions. However, the portion of world production that is exported grew slightly during the last decade from 32.4 to 37.2 per cent. This is explained mainly by the growth in SX-EW production (particularly in Chile), which allows the

processing of ore in the mining site (see chapter III).

154. The largest share in world exports of refined copper is controlled by developing countries with large integrated operations from the mining stage to the refining stage and by developed countries with large refining capacity but low domestic absorption of the metal (tables 46 and 47). In 1978 Chile displaced Zambia as the largest exporter of refined copper and increased its lead ever since.[63] During the 1980s Chilean exports grew by 4.2 per cent p.a. and by the end of the period the country accounted for almost one third of total world exports. Meanwhile, Zambian exports declined by the same rate as domestic production (3.4 per cent), which caused a fall in the country's share from 19.3 per cent to 10.5 per cent of the world total. As a consequence of the growth in exports from Chile and the fall in those from Zambia and Belgium, Chile became the largest foreign supplier of refined copper to the major importing countries, except for Germany and the United States[64] (tables 50 and 51). As in the case of concentrates, its main markets for refined copper are Western Europe and the developed and rapidly industrializing countries of Asia (including China).

155. Although Peru's refined production was roughly constant during the second half of the 1980s, its consumption fell by 5.3 per cent p.a.. This allowed the country to increase its refined exports by 2.5 per cent and keep its share of 5.3 per cent of the world total.

156. Among developed countries the largest exporter from 1983 onwards was Canada, whose exports increased rapidly at the end of the 1980s because consumption did not pick up at the same rate as production. However, as with concentrates exports, the most important shift among industrialized countries took place in the United States. Since the early 1970s the country had been a net importer of refined copper, a situation that was accentuated in the first half of the 1980s. Domestic refined production fell thereafter considerably more than consumption, due to capacity cuts and closures, which turned the country into the world's largest importer. Also as a consequence, in 1985-1987, 90 per cent of American imports of unwrought copper consisted of refined metal (whereas at the beginning of the 1980s the proportion had been 60 per cent). However, the subsequent rebound in production allowed the country to increase refined exports by 51.5 per cent p.a. between 1985-1987 and 1990-1992, although it continued to be, overall, a net importing country of refined copper. The country thus became the world's fourth largest exporter at the end of that period. As mentioned earlier, this contributed to the sharp drop of its net imports of unmanufactured copper (chart 8).

157. Another change in relative positions among developed countries occurred in the case of Belgium. Its refined copper exports declined by 4.2 per cent p.a. between 1980 and 1992 and the country fell from the third to the seventh position among the largest exporters, in line with the reduction in its output. Simultaneously it increased its imports by 5.2 per cent p.a. and thus became a net importer of refined copper. This stage of processing, which in 1980-1982 had accounted for 29.4 per cent of the country's total unwrought imports, became the most important item, corresponding to 57.7 per cent in 1990-1992.

158. Exports of refined copper from the countries of Eastern Europe mainly originate in the former USSR and Poland and underwent a dramatic change at the end of the 1980s and the beginning of the 1990s (tables 50 and 51). Between 1981 and 1986 Soviet refined copper exports oscillated around the level of 100 ktpy, of which approximately 77 per cent[65] were absorbed by other socialist countries.

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[63] In both Chile and Zambia domestic consumption amounts to less than 5 per cent of national refined production and the level of exports thus is basically determined by the amount of production.

[64] Although Chile was the largest exporter to both Germany and the United States in the early 1980s, it was displaced by Poland and Canada, respectively, at the end of the decade.

[65] These figures are approximate, because detailed trade statistics for the former socialist countries, especially bilateral trade flows, are not available.

From 1987 onwards, however, the fall in domestic consumption (which was accentuated after 1990) caused exports to double to 200 ktpy and above in 1990-1992. This surge in exports and the drastic reduction of imports by other former socialist countries (due to the economic crisis they were experiencing) caused the diversion of the increased USSR/CIS exports to Western markets. Refined exports from the former USSR to countries outside the former socialist block jumped from 42,600 tpy in 1985-1987 to 183,500 tpy in 1990-1992. During the latter period, they accounted for 89 per cent of total USSR/CIS exports of refined copper (as opposed to 39 per cent in 1985-1987). The rapid increase of exports of the former USSR and the diversion of its flows has had a strong impact on the world copper market (see chapter V).

159. A similar process occurred in Poland, though in this case the impact of increased exports was not as dramatic. Already during the early 1980s Poland was directing to Western markets a considerably higher proportion of its exports than the former USSR. Between 1980 and 1985, Polish refined copper exports grew at an annual rate of 5.3 per cent p.a.. In the following five years they fell, especially in 1989 and 1990, because of the combination of the drop in domestic output with the deterioration of the economic situation of other Eastern European countries. This caused a sharp fall in refined copper imports by other countries of the group, which had previously accounted for approximately 40 per cent of total Polish exports. In 1991 and 1992, however, national refined copper production started expanding again while domestic consumption did not pick up. This caused a quick increase in exports from 155,200 t in 1986-1990 to 226,400 in 1991-1992. Since demand in the other Eastern European countries continued to be depressed at the beginning of the 1990s, the bulk of the increase in Polish exports was directed to Western markets. In 1990-1992 they absorbed 85 per cent of the country's total exports of refined copper.

160. Developed countries account for the bulk of refined copper imports, though their share decreased from 76.3 to 72.7 per cent between 1980-1982 and 1990-1992 (table 48). The largest importer is Germany, which unlike Japan has more of its unwrought copper imports made up of refined metal (73.7 per cent) than of ore (tables 49, 34 and 35).

161. The sharp increase of East European refined copper exports in the early 1990s had its strongest impact on Western European markets. In Germany, the share of the USSR/CIS[66] in total imports jumped from less than 1 per cent in 1980-1982 to 19.1 per cent in the early 1990s. Poland, which had traditionally penetrated the German market, experienced an increase in its share from 19.1 to 24.2 per cent. It thus displaced Chile as the largest foreign supplier of refined copper to Germany. Therefore, in 1990-1992 Poland and the USSR/CIS accounted for almost half of German refined copper imports.

162. Japanese refined imports grew by 7.9 per cent p.a. during the 1980s, because domestic production did not cover the 2.3 per cent annual growth in consumption. Japanese output grew by only 0.3 per cent p.a. over the same period, due to the reduction of refining capacity at the end of the decade. Thus, the country passed from the fifth to the second position among the largest importers of refined metal. The share of refined metal in total Japanese unwrought copper imports rose from 20.7 to 35.7 per cent over that period (tables 34 and 35).

163. The importance of developing countries as refined copper importers grew during the 1980s when their foreign purchases doubled. This was due to the expansion of imports by South and South-East Asian nations. Taiwan, Province of China, whose only large refinery was closed down in 1990, had to increase its imports by 23.2 per cent p.a. to meet the rapidly growing demand. It thus became the fifth largest importer in the world. The Republic of Korea, on the other hand, although it doubled its domestic production of refined copper during the 1980s, had to raise imports by 20.6 per cent p.a. because of its quickly expanding consumption (which rose at 11 per cent p.a.). Altogether, the region was responsible for 19.3 per cent of world imports of refined copper in 1990-1992, as opposed to 4.8 per cent ten years earlier. Among other developing countries, Brazil reduced its refined copper imports

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[66] Figures include exports from all republics of the former USSR.

by two thirds because of the decline in demand and the increased processing of concentrates in the country.

164. Imports into Eastern European countries followed a declining trend during the 1980s and at the beginning of the 1990s. However, the fall accelerated from 1988 onwards, due to the economic crisis experienced by these countries, which worsened in the early 1990s. Their refined copper imports, which had fallen by an annual rate of 0.6 per cent p.a. between 1980 and 1987, dropped by 22.1 per cent p.a. between 1988 and 1992.[67] This reduced demand, mainly for exports from the former USSR and Poland, but also for those from Western countries.

165. Chinese imports of refined copper, which averaged 115,500 tpy in 1980-1982, increased sharply to 365,200 tpy in 1983-1985 (a period of low prices). China thus became the world's third largest importer. These additional imports were probably destined to build up stocks, since available statistics show that the gap between domestic refined production and consumption remained roughly constant during those years. From 1986 to 1990, when international prices rose sharply, the country's imports fell abruptly from 171,700 t to 38,400 t, when there was a likely drawdown in stocks. In 1990 and 1992, however, the country's consumption grew at a much quicker pace than its production. This led the country to step up its imports, which reached 265,700 t in 1992. The increase in Chinese refined imports at the beginning of the 1990s enabled the country to play an important role in the world copper market. Together with the countries of South and South-East Asia, it helped to sustain world demand and prices at a time of rising exports from Eastern Europe and stagnant or declining consumption in developed countries.

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[67] Excluding the former East Germany.

V. MARKET BALANCE, STOCKS AND PRICES

166. Since 1970, copper prices have gone through three major price cycles, with peaks in 1974, 1980 and 1989 and troughs in 1972, 1975 and 1986. This places all of the 1980s between two peaks and the early 1990s on a downward slope. As chart 9 shows, the price curve in the last 20 years moved opposite to that of the market balance, which is roughly parallel to the curve of commercial stocks.

167. After reaching a cyclical peak in 1980, copper prices began to fall in the following year. The supply deficit in 1980-1981 was markedly lower than in 1978-1979 (123 kt, compared to 570 kt, on average) and stocks stabilized, reversing their fall since 1978. However, the real turnaround came in 1982, when the world recession caused consumption to fall much more steeply than world production. This created the first supply surplus in six years and led to a sharp increase in commercial stocks and to a further fall in prices. The problems that this acute fall in consumption and prices caused to producers led to sharp cuts in capacity and the retrenchment of production (especially in the United States). This process was so deep that the demand increases occurring already from 1983 onwards were met by stock drawdowns rather than by production expansion. Consequently, between 1982 and 1986 commercial stocks were more than halved and in 1987 they reached their lowest level in 18 years.

168. The persistence of a market deficit since 1984, combined with the sharp reduction of stocks led to an extremely rapid increase in prices between 1987 and 1989. During those years they doubled, peaking above 150 c/lb between the end of 1988 and early 1989, the highest nominal level ever reached. At the same time, production expanded steadily after 1986, more on a par with total consumption, which led to a slow increase in stock levels from 1987 onwards.

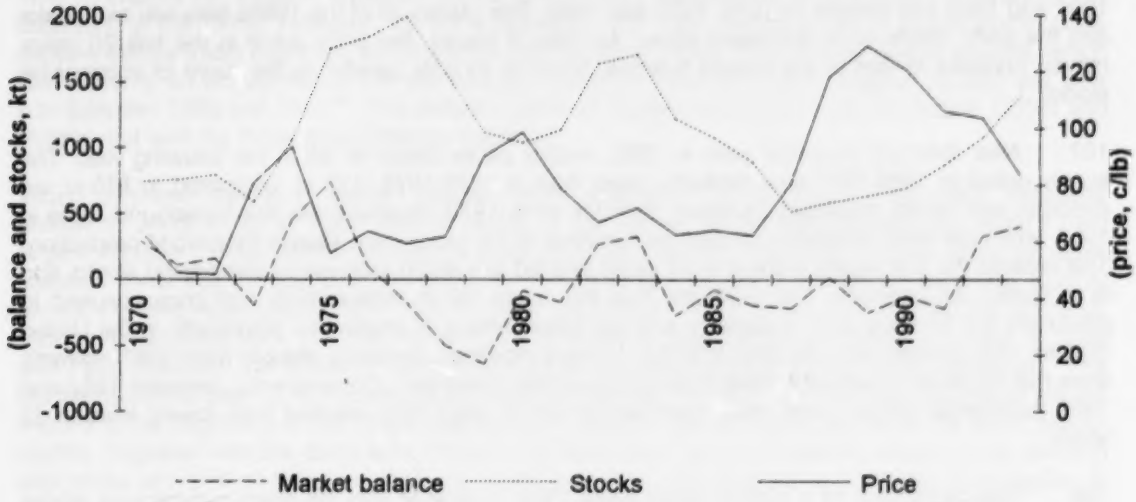
169. Copper prices began falling as early as the second quarter of 1989, but at a slow pace, so that, on average, prices during that year were still above those prevailing in 1988. In 1990 they experienced a slight recovery that continued until September, sustained mainly by supply disruptions. Thereafter, and during all of 1991, they fell sharply and were thus, on average, 12 per cent lower in 1991 than in the previous year, owing to the combination of slower demand growth, the buildup of stocks and increased exports from Eastern Europe.

170. In the early 1990s copper demand suffered from the slowdown in economic activity in developed countries and from the slump in consumption in Eastern Europe. The developments in the former socialist countries of Eastern Europe had a continuing strong negative influence on the copper market because of reduced domestic demand for the metal and the growth of exports from the former USSR and Poland. The impact of the economic slowdown in developed countries on the price of copper, however, was mitigated by the fact that there were differences in the timing of recession among them. Thus, copper consumption already fell in the United States in 1990 and 1991, while in Western Europe (excluding Germany) it did not drop until 1991. In Japan demand slackened as late as 1992. However, this did not prevent the buildup of stocks. In 1991 and 1992 they rose quickly by 24 per cent p.a., whereas they had accumulated at an annual rate of 9 per cent during the two preceding years.

171. In 1992, the market was in surplus, but prices fell only slightly. They were underpinned by the doubling of Chinese imports, the continuing growth of imports from South and South-East Asia, and by supply disruptions, mainly in Zaire and in the former Yugoslavia. In 1993, the effects of the world recession were fully felt in the copper market, as some of the countervailing factors ceased to operate. Consequently, in the first half of the year, copper prices fell to 90 c/lb, averaging 11 per cent less than in 1992. This was not enough to induce cuts in production, however, except for some marginal mines that were temporarily shut down. The largest producers have become more resilient to price falls due to the generalized reduction in costs achieved by them during the 1980s, a trend that continued in the early 1990s. Therefore, only a considerably sharper price fall would lead to output cutbacks.

Chart 9

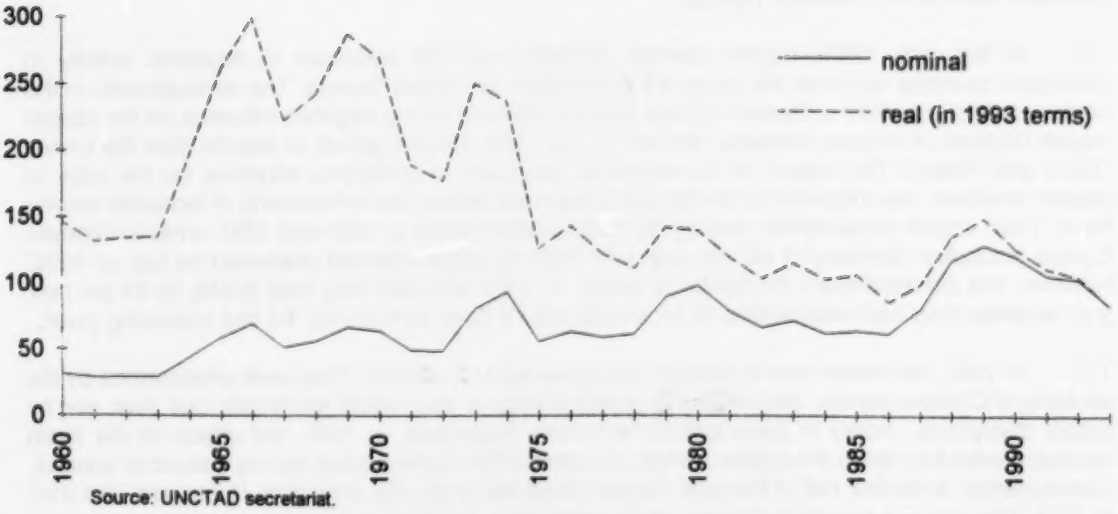
Copper market balance, stocks and prices, 1970-1993



Source: UNCTAD secretariat.

Chart 10

Nominal and real copper prices, 1960-1993
(LME cash, US cents/lb)



Source: UNCTAD secretariat.

172. In real terms, however, copper prices maintained their downward trend during the 1980s, though at a much reduced rate compared to that prevailing in the 1970s (chart 10). Whereas the real price of the metal fell at an annual rate of 5.4 per cent in the 1970s, the decline in the following decade was only 1 per cent p.a.. This was due mainly to the sharp increases in nominal prices in 1987-1989. Consequently, in 1990 the price, in real terms, was just 10 per cent below its level ten years earlier. In the following years, prices dropped sharply in real terms. This points to a continuation of the long-term downward trend of real prices. To reverse that trend, an increase in nominal terms even stronger than that of the late 1980s would have to take place.

173. Over the medium term, the perspectives for the copper market are generally considered positive and prices might experience a significant increase in the coming years. World demand for the metal is expected to grow until the end of the century by between 2 per cent p.a. and 3.46 per cent p.a. (see chapter I). If the actual outcome of consumption expansion is in the lower range of these forecasts, there should be a balanced growth of supply and demand. This is due to the fact that mine capacity (and consequently primary production) is forecast to expand by an annual rate of 2.6 per cent in the West and of 2.17 per cent worldwide (see chapter II). However, if consumption of the metal accelerates at a rate of over 3 per cent p.a., the projects now envisaged will not be sufficient to meet growing demand (supposing a constant rate of recycling). In the short term this would probably bring about significant price increases. Over the medium term, it could lead to the emergence of a need for more intensified exploration efforts and for the development of new projects at a quicker pace than is now being planned by mining companies.

ANNEX

List of tables

1. Consumption of refined copper by regions
2. Largest refined copper consuming countries
3. Intensity of use of copper by regions
4. Per capita copper consumption by regions
5. Copper consumption by end-use
6. Market shares of the five largest mine copper producing companies of the Western world, 1925-2000
7. Largest copper mining companies of the Western world in 1980
8. Largest copper mining companies of the Western world in 1990
9. Largest copper mining companies of the Western world in 2000 (projected)
10. Largest copper smelting companies of the Western world in 1980
11. Largest copper smelting companies of the Western world in 1990
12. Largest copper smelting companies of the Western world in 2000 (projected)
13. Largest copper refining companies of the Western world in 1980
14. Largest copper refining companies of the Western world in 1990
15. Largest copper refining companies of the Western world in 2000 (projected)
16. Concentration in the Western unwrought copper industry, 1980-2000
17. Country of origin of copper mining companies and geographical distribution of their capacities
18. Country of origin of copper smelting companies and geographical distribution of their capacities
19. Country of origin of copper refining companies and geographical distribution of their capacities
20. Main privatization transactions in the copper industry
21. Mine production of copper by regions
22. Largest mine copper producing countries
23. World mine capacity trends
24. Production of unrefined copper by regions
25. Largest unrefined copper producing countries
26. Production of refined copper by regions
27. Largest refined copper producing countries
28. Regional distribution of Western smelting and refining capacity
29. Major changes to production capacity for Western copper mines, 1993-1997
30. Major changes to production capacity for Western copper smelters, 1993-1997
31. Major changes to production capacity for Western copper refineries, 1993-1997
32. Largest net exporters of unwrought copper, 1980-1982
33. Largest net exporters of unwrought copper, 1990-1992
34. Largest net importers of unwrought copper, 1980-1982
35. Largest net importers of unwrought copper, 1990-1992
36. Exports of copper ore and concentrates by regions
37. Largest copper ore and concentrates exporting countries
38. Imports of copper ore and concentrates by regions
39. Largest copper ore and concentrates importing countries
40. Bilateral copper ore trade flows, 1980-1982
41. Bilateral copper ore trade flows, 1990-1992
42. Exports of unrefined copper by regions
43. Largest unrefined copper exporting countries
44. Imports of unrefined copper by regions
45. Largest unrefined copper importing countries
46. Exports of refined copper by regions
47. Largest refined copper exporting countries
48. Imports of refined copper by regions

49. Largest refined copper importing countries
50. Bilateral refined copper trade flows, 1980-1982
51. Bilateral refined copper trade flows, 1990-1992

Table 1
Consumption of refined copper by regions
(thousand tons and %)

	1980-1982	Share (% of world)	Growth rate since 1970-72 (% pa)	1990-1992	Share (% of world)	Growth rate since 1980-82 (% pa)
WORLD	**9434.1**	**100.0**	**2.3**	**10763.5**	**100.0**	**1.3**
Developed market-economy countries	**6174.7**	**65.5**	**1.1**	**7134.4**	**66.3**	**1.5**
America	2166.8	23.0	0.2	2334.9	21.7	0.8
Europe	2567.8	27.2	0.8	3083.7	28.6	1.8
South Africa	86.7	0.9	7.6	63.9	0.6	-3.0
Asia	1218.5	12.9	3.6	1533.9	14.3	2.3
Oceania	135.0	1.4	1.6	118.0	1.1	-1.3
Developing countries and territories	**970.0**	**10.3**	**8.7**	**1800.0**	**16.7**	**6.4**
America	460.0	4.9	7.6	423.4	3.9	-0.8
Africa	27.0	0.3	6.4	28.8	0.3	0.6
Asia	348.0	3.7	12.7	1268.7	11.8	13.8
Europe	134.4	1.4	5.1	79.0	0.7	-5.2
Oceania	0.5	0.0		0.0	0.0	-24.2
Countries in Eastern Europe	**1899.4**	**20.1**	**3.5**	**1218.3**	**11.3**	**-4.3**
Socialist countries of Asia	**390.0**	**4.1**	**5.8**	**610.8**	**5.7**	**4.6**

Table 2
Largest refined copper consuming countries
(% of world total)

1980-1982		1990-1992	
United States	20.9	United States	20.0
USSR	13.9	Japan	14.3
Japan	12.9	Germany	9.1
Germany	7.9	USSR/CIS	8.3
France	4.5	China	5.4
China	4.0	Italy	4.5
United Kingdom	3.9	France	4.4
Italy	3.9	Taiwan, Pr. China	3.4
Belgium	3.0	Belgium	3.4
Brazil	2.4	Korea, Republic of	3.2
Total	77.1	**Total**	75.9

Source: Metallgesellschaft, Metal Statistics.

Table 3

Intensity of use of copper by regions

(kg Cu/US$ million GDP, NMP or national income in 1985 prices)

	1960-1964	1965-1969	1970-1974	1975-1979	1980-1984	1985-1989	1990-1991
WORLD	**1100.6**	**1049.4**	**1008.8**	**949.2**	**895.8**	**836.6**	**817.0**
Developed market-economy countries	**1025.0**	**970.8**	**927.0**	**830.2**	**773.6**	**708.2**	**701.5**
America	749.0	784.0	707.4	589.4	554.6	517.2	472.5
Europe	1400.0	1179.4	1125.6	1029.2	934.6	880.6	901.5
South Africa	1236.2	967.4	1231.4	1290.2	1515.8	1250.8	1056.5
Asia	1081.2	1123.0	1154.8	1131.4	1043.8	894.8	929.5
Oceania	1032.0	1045.2	955.0	801.0	804.8	654.6	549.5
Developing countries and territories	**510.2**	**438.2**	**493.0**	**573.2**	**675.8**	**823.8**	**940.5**
America	529.8	569.0	682.4	791.6	751.6	772.8	623.0
Africa	107.8	62.6	136.6	353.0	374.0	355.4	390.0
Asia	348.6	192.4	219.6	292.8	507.0	793.4	1098.5
Europe	3423.0	3190.0	3120.8	2962.4	3001.4	2834.2	2259.0
Countries in Eastern Europe	**2886.2**	**2827.6**	**2517.4**	**2453.0**	**2164.6**	**1876.2**	**1467.5**
Socialist countries of Asia	**2218.2**	**1914.0**	**2049.0**	**2273.4**	**1813.8**	**1345.2**	**1207.0**

Source: UNCTAD secretariat.

Table 4
Per capita copper consumption by regions
(kg Cu/person)

	1960-1964	1965-1969	1970-1974	1975-1979	1980-1984	1985-1989	1990-1992
WORLD	**2.2**	**2.3**	**2.5**	**2.6**	**2.6**	**2.6**	**2.5**
Developed market-economy countries	**6.4**	**7.3**	**8.2**	**8.1**	**8.1**	**8.4**	**8.7**
America	7.8	9.6	9.5	8.7	8.6	8.9	8.3
Europe	6.5	6.3	7.3	7.4	7.3	7.6	8.3
South Africa	1.6	1.5	2.1	2.2	2.7	2.1	1.6
Asia	3.7	6.0	8.7	9.7	10.4	10.8	12.3
Oceania	6.0	7.0	7.6	6.8	7.2	6.5	5.7
Developing countries and territories	**0.3**	**0.3**	**0.4**	**0.5**	**0.6**	**0.8**	**1.0**
America	0.6	0.8	1.2	1.5	1.5	1.6	1.3
Africa	0.0	0.0	0.1	0.2	0.2	0.3	0.3
Asia	0.1	0.1	0.1	0.2	0.3	0.6	0.9
Europe	2.7	3.3	4.2	5.1	5.8	5.4	3.3
Countries in Eastern Europe	**2.7**	**3.5**	**4.1**	**5.1**	**5.1**	**4.9**	**2.9**
Socialist countries of Asia	**0.2**	**0.2**	**0.3**	**0.4**	**0.4**	**0.4**	**0.5**

Source: UNCTAD secretariat.

Table 5
Copper consumption by end-use (%)

Sector	Western world		United States	
	1979	1991	1980-1982	1990-1992
Electrical and electronic products	45	47	28	25
Building construction	20	22	33	42
Industrial machinery and equipment	14	13	17	13
Consumer and lighting engineering	11	9		
Consumer and general products			12	9
Transportation equipment	10	9	11	11
TOTAL	**100**	**100**	**100**	**100**

Sources: For Western world, Metallgesellschaft,
for United States, CDA.

Note: Definitions used for the Western world and for the United States are not compatible.

Table 6
Market shares of the five largest mine copper producing companies of the Western world, 1925-2000 (a)

1925		1935		1948		1960	
Kennecott	22.8	Anaconda	17.1	Kennecott	21.6	Kennecott	14.4
Anaconda	18.6	Kennecott	13.6	Anaconda	15.2	Anaconda	13.0
Calumet	7.6	Nickel International	7.8	Phelps Dodge	10.4	Anglo American	10.2
Phelps Dodge	7.2	Union Minière	7.8	Union Minière	7.2	Union Minière	8.4
Union Minière	6.8	Amax Roan	6.6	Amax Roan	5.7	Amax Roan	6.1
Five largest	**63.0**	**Five largest**	**52.9**	**Five largest**	**60.1**	**Five largest**	**52.1**
1969		**1980**		**1990**		**2000**	
Kennecott	13.3	Codelco	13.0	Codelco	14.6	Codelco	14.1
Anaconda	11.3	Gécamines	8.9	Gécamines	7.4	Phelps Dodge	5.8
Anglo American	8.0	Zimco	5.9	Phelps Dodge	6.7	Gécamines	5.1
Union Minière	7.5	Kennecott	5.6	Asarco	4.8	RTZ	5.0
Amax Roan	7.0	Phelps Dodge	4.5	Zimco	4.8	Asarco	4.7
Five largest	**47.1**	**Five largest**	**38.0**	**Five largest**	**38.4**	**Five largest**	**34.6**

Sources: For 1925 to 1969, Marcondes, Silva, and Martínez, The copper and aluminium industries. A review of structural changes. Resources Policy, March 1985; for 1980 to 2000, tables 7 to 9 of this paper.

(a) Data for 1925 to 1969 refer to shares in total Western production; for 1980 to 2000 they indicate shares in production capacity.

Table 7
Largest copper mining companies of the Western world in 1980

	Company	Country of origin	Mine capacity (a) (000 tpy Cu)	Share of Western world (%)	cumulative
1	Codelco	Chile	1003.0	13.0	13.0
2	Gécamines	Zaire	684.0	8.9	21.9
3	Zimco	Zambia	456.5	5.9	27.8
4	Kennecott	United States	429.0	5.6	33.4
5	Phelps Dodge	United States	349.4	4.5	38.0
6	Anglo American	South Africa	281.8	3.7	41.6
7	Asarco	United States	242.2	3.1	44.8
8	Arco Metals	United States	239.8	3.1	47.9
9	RTZ	United Kingdom	202.7	2.6	50.5
10	Duval	United States	169.0	2.2	52.7
11	MIM Holdings	Australia	150.0	1.9	54.7
12	Inco	Canada	135.0	1.8	56.4
13	Atlas Consolidated	Philippines	130.0	1.7	58.1
14	Mexicana de Cobre	Mexico	125.0	1.6	59.7
15	Cyprus	United States	121.0	1.6	61.3
16	Cities Services	United States	102.0	1.3	62.6
17	RTB Bor	Yugoslavia	96.0	1.2	63.9
18	Cons Gold Fields Plc	United Kingdom	95.8	1.2	65.1
19	Enami	Chile	80.0	1.0	66.2
20	Brascan	Canada	78.4	1.0	67.2
21	Amax	United States	66.6	0.9	68.0
22	Canada Development Corp	Canada	64.0	0.8	68.9
23	Minero Perú	Peru	63.0	0.8	69.7
24	Falconbridge	Canada	60.0	0.8	70.5
25	Outokumpu	Finland	54.0	0.7	71.2
26	Boliden	Sweden	52.0	0.7	71.8
27	Cerro Marmon	United States	51.4	0.7	72.5
28	Freeport McMoRan	United States	51.2	0.7	73.2
29	General Electric	United States	50.0	0.6	73.8
30	Placer Dome	Canada	45.2	0.6	74.4
	Others		1969.9	25.6	100.0
	Western world total		7697.8		

Source: UNCTAD secretariat, based on several sources.

(a) Includes mines producing ore processed through the conventional method and through SX-EW.

Table 8
Largest copper mining companies of the Western world in 1990

	Company	Country of origin	Mine capacity (a) (000 tpy Cu)	Share of Western world (%)	cumulative
1	Codelco	Chile	1338.3	14.6	14.6
2	Gécamines	Zaire	680.3	7.4	22.0
3	Phelps Dodge	United States	616.2	6.7	28.7
4	Asarco	United States	443.8	4.8	33.6
5	Zimco	Zambia	442.9	4.8	38.4
6	RTZ	United Kingdom	402.0	4.4	42.8
7	Cyprus	United States	323.3	3.5	46.3
8	Magma	United States	306.0	3.3	49.6
9	Anglo American	South Africa	255.7	2.8	52.4
10	Ind. Minera México	Mexico	205.4	2.2	54.7
11	MIM Holdings	Australia	188.7	2.1	56.7
12	Freeport McMoRan	United States	168.5	1.8	58.6
13	Minero Perú	Peru	159.8	1.7	60.3
14	Trelleborg	Sweden	144.6	1.6	61.9
15	Inco	Canada	139.0	1.5	63.4
16	Nat. Iranian Copper Ind.	Iran, Isl. Rep. of	130.0	1.4	64.8
17	RTB Bor	Yugoslavia	129.4	1.4	66.2
18	Brascan	Canada	122.6	1.3	67.6
19	Exxon	United States	120.5	1.3	68.9
20	BHP	Australia	111.1	1.2	70.1
21	Atlas Consolidated	Philippines	92.5	1.0	71.1
22	Emp. Desenv. Mineiro	Portugal	84.2	0.9	72.0
23	Enami	Chile	83.0	0.9	72.9
24	Acec-Union Minière	Belgium	76.0	0.8	73.7
25	Etibank	Turkey	66.0	0.7	74.5
26	Metallgesellschaft	Germany	61.3	0.7	75.1
27	Hindustan Copper Co.	India	59.0	0.6	75.8
28	Outokumpu	Finland	58.2	0.6	76.4
29	Mitsubishi	Japan	55.4	0.6	77.0
30	Sumitomo	Japan	50.3	0.5	77.6
	Others		2059.1	22.4	100.0
	Western world total		9173.0		

Source: UNCTAD secretariat, based on several sources.

(a) Includes mines producing ore processed through the conventional method and through SX-EW.

Table 9
Largest copper mining companies of the Western world in 2000 (projected)

	Company	Country of origin	Mine capacity (a) (000 tpy Cu)	Share of Western world (%)	cumulative
1	Codelco	Chile	1637.5	14.1	14.1
2	Phelps Dodge	United States	675.3	5.8	19.9
3	Gécamines	Zaire	591.0	5.1	25.0
4	RTZ	United Kingdom	581.9	5.0	30.0
5	Asarco	United States	541.7	4.7	34.6
6	Zimco	Zambia	412.2	3.5	38.2
7	Anglo American	South Africa	377.1	3.2	41.4
8	Cyprus	United States	334.7	2.9	44.3
9	BHP	Australia	333.7	2.9	47.2
10	Freeport McMoRan	United States	298.8	2.6	49.7
11	Magma	United States	261.6	2.3	52.0
12	Ind. Minera México	Mexico	229.0	2.0	54.0
13	Nat. Iranian Copper Ind.	Iran, Isl. Rep. of	228.0	2.0	55.9
14	MIM Holdings	Australia	212.5	1.8	57.8
15	Rio Algom	Canada	210.0	1.8	59.6
16	Exxon	United States	189.7	1.6	61.2
17	Trelleborg	Sweden	175.8	1.5	62.7
18	Enami	Chile	161.0	1.4	64.1
19	Inco	Canada	150.0	1.3	65.4
20	Billiton	Netherlands	125.0	1.1	66.5
21	Brascan	Canada	123.1	1.1	67.5
22	RTB Bor	Yugoslavia	115.3	1.0	68.5
23	Antofagasta Holdings Plc	United Kingdom	113.5	1.0	69.5
24	Atlas Consolidated	Philippines	110.0	0.9	70.4
25	Western Mining Corp	Australia	109.0	0.9	71.4
26	Placer Dome	Canada	101.7	0.9	72.2
27	Outokumpu	Finland	91.8	0.8	73.0
28	Acec-Union Minière	Belgium	86.1	0.7	73.8
29	Mitsubishi	Japan	84.6	0.7	74.5
30	Minero Perú	Peru	83.5	0.7	75.2
	Others		2881.0	24.8	100.0
	Western world total		11626.1		

Source: UNCTAD secretariat, based on several sources.

(a) Includes mines producing ore processed through the conventional method and through SX-EW.

Table 10
Largest copper smelting companies of the Western world in 1980

	Company	Country of origin	Smelting capacity (a) (000 tpy Cu)	Share of Western world (%)	cumulative
1	Codelco	Chile	700.0	8.5	8.5
2	Phelps Dodge	United States	504.9	6.1	14.6
3	Gécamines	Zaire	482.5	5.9	20.5
4	Asarco	United States	470.1	5.7	26.2
5	Kennecott	United States	427.7	5.2	31.4
6	Zimco	Zambia	361.8	4.4	35.8
7	Nippon Mining	Japan	324.0	3.9	39.7
8	Mitsubishi	Japan	273.5	3.3	43.0
9	Anglo American	South Africa	251.1	3.0	46.1
10	Brascan	Canada	194.2	2.4	48.4
11	Metallgesellschaft	Germany	170.3	2.1	50.5
12	Inco	Canada	170.0	2.1	52.6
13	Sumitomo	Japan	168.0	2.0	54.6
14	Mitsui Mining & Smelting	Japan	167.2	2.0	56.6
15	Arco Metals	United States	165.5	2.0	58.6
16	Enami	Chile	165.0	2.0	60.6
17	RTB Bor	Yugoslavia	160.0	1.9	62.6
18	MIM Holdings	Australia	150.0	1.8	64.4
19	Dowa Mining	Japan	123.9	1.5	65.9
20	RTZ	United Kingdom	108.2	1.3	67.2
21	Cerro Marmon	United States	104.6	1.3	68.5
22	Furukawa Mining	Japan	104.1	1.3	69.8
23	Amax	United States	98.1	1.2	70.9
24	Hüttenwerke Kayser	Germany	96.7	1.2	72.1
25	Cons Gold Fields Plc	United Kingdom	91.9	1.1	73.2
26	Boliden	Sweden	90.0	1.1	74.3
27	IMI	United Kingdom	75.0	0.9	75.2
28	Degussa	Germany	69.2	0.8	76.1
29	Minero Perú	Peru	62.0	0.8	76.8
30	Taiwan Metal Mining Corp.	Taiwan, Pr. China	62.0	0.8	77.6
	Others		1846.3	22.4	100.0
	Western world total		8237.7		

Source: UNCTAD secretariat, based on several sources.

(a) Includes smelters and leach plants producing low-grade cathode.

Table 11
Largest copper smelting companies of the Western world in 1990

	Company	Country of origin	Smelting capacity (a) (000 tpy Cu)	Share of Western world (%)	cumulative
1	Codelco	Chile	989.0	10.5	10.5
2	Gécamines	Zaire	488.5	5.2	15.7
3	Asarco	United States	458.3	4.9	20.6
4	Mitsubishi	Japan	370.0	3.9	24.5
5	Nippon Mining	Japan	336.0	3.6	28.1
6	Zimco	Zambia	328.6	3.5	31.6
7	Phelps Dodge	United States	308.8	3.3	34.9
8	MIM Holdings	Australia	298.3	3.2	38.0
9	Magma	United States	295.0	3.1	41.2
10	RTZ	United Kingdom	256.1	2.7	43.9
11	Anglo American	South Africa	217.7	2.3	46.2
12	Enami	Chile	210.0	2.2	48.4
13	Sumitomo	Japan	205.2	2.2	50.6
14	Lucky Goldstar	Korea, Republic of	200.0	2.1	52.8
15	Southwire	United States	190.0	2.0	54.8
16	Ind. Minera México	Mexico	177.7	1.9	56.7
17	Cyprus	United States	175.0	1.9	58.5
18	Inco	Canada	170.0	1.8	60.3
19	RTB Bor	Yugoslavia	170.0	1.8	62.1
20	Brascan	Canada	166.7	1.8	63.9
21	Caraíba Metais	Brazil	160.0	1.7	65.6
22	Trelleborg	Sweden	159.0	1.7	67.3
23	Kuwait Investment Office	Kuwait	145.0	1.5	68.9
24	Nat. Iranian Copper Ind.	Iran, Isl. Rep. of	145.0	1.5	70.4
25	Metallgesellschaft	Germany	139.8	1.5	71.9
26	Mitsui Mining & Smelting	Japan	137.5	1.5	73.3
27	Stà. Metallurgica Italiana	Italy	131.0	1.4	74.7
28	Dowa Mining	Japan	130.2	1.4	76.1
29	Furukawa Mining	Japan	126.5	1.3	77.5
30	Chemetco	United States	125.0	1.3	78.8
	Others		1994.3	21.2	100.0
	Western world total		9404.2		

Source: UNCTAD secretariat, based on several sources.

(a) Includes smelters and leach plants producing low-grade cathode.

Table 12
Largest copper smelting companies of the Western world in 2000 (projected)

	Company	Country of origin	Smelting capacity (a) (000 tpy Cu)	Share of Western world (%)	cumulative
1	Codelco	Chile	1126.0	10.3	10.3
2	Gécamines	Zaire	601.0	5.5	15.8
3	Asarco	United States	481.3	4.4	20.2
4	Mitsubishi	Japan	409.9	3.8	24.0
5	Zimco	Zambia	397.4	3.6	27.6
6	MIM Holdings	Australia	377.7	3.5	31.0
7	Nippon Mining	Japan	372.0	3.4	34.4
8	Phelps Dodge	United States	340.5	3.1	37.6
9	RTZ	United Kingdom	336.8	3.1	40.6
10	Magma	United States	325.0	3.0	43.6
11	Enami	Chile	250.0	2.3	45.9
12	Anglo American	South Africa	237.9	2.2	48.1
13	Metallgesellschaft	Germany	234.7	2.1	50.2
14	Trelleborg	Sweden	217.5	2.0	52.2
15	Cyprus	United States	214.0	2.0	54.2
16	Sumitomo	Japan	208.6	1.9	56.1
17	Lucky Goldstar	Korea, Republic of	200.0	1.8	57.9
18	Brascan	Canada	198.0	1.8	59.7
19	Inco	Canada	185.0	1.7	61.4
20	Southwire	United States	183.0	1.7	63.1
21	Ind. Minera México	Mexico	177.7	1.6	64.7
22	RTB Bor	Yugoslavia	170.0	1.6	66.3
23	Mitsui Mining & Smelting	Japan	165.3	1.5	67.8
24	Caraíba Metais	Brazil	160.0	1.5	69.3
25	Nat. Iranian Copper Ind.	Iran, Isl. Rep. of	145.0	1.3	70.6
26	Furukawa Mining	Japan	143.2	1.3	71.9
27	Stà. Metallurgica Italiana	Italy	131.0	1.2	73.1
28	Dowa Mining	Japan	130.2	1.2	74.3
29	Freeport McMoRan	United States	129.5	1.2	75.5
30	Chemetco Metals	United States	125.0	1.1	76.6
	Others		2556.6	23.4	100.0
	Western world total		10929.8		

Source: UNCTAD secretariat, based on several sources.

(a) Includes smelters and leach plants producing low-grade cathode.

Table 13
Largest copper refining companies of the Western world in 1980

	Company	Country of origin	Refining capacity (a) (000 tpy Cu)	Share of Western world (%)	cumulative
1	Kennecott	United States	969.3	10.3	10.3
2	Codelco	Chile	641.0	6.8	17.2
3	Phelps Dodge	United States	486.0	5.2	22.3
4	Acec-Union Minière	Belgium	444.0	4.7	27.1
5	Zimco	Zambia	419.1	4.5	31.5
6	Asarco	United States	381.0	4.1	35.6
7	Nippon Mining	Japan	360.0	3.8	39.4
8	Mitsubishi	Japan	316.9	3.4	42.8
9	Minero Perú	Peru	238.0	2.5	45.3
10	Amax	United States	219.5	2.3	47.7
11	Brascan	Canada	203.5	2.2	49.8
12	Arco Metals	United States	201.7	2.1	52.0
13	Anglo American	South Africa	193.7	2.1	54.0
14	Metallgesellschaft	Germany	181.4	1.9	56.0
15	Sumitomo	Japan	180.0	1.9	57.9
16	Gécamines	Zaire	170.0	1.8	59.7
17	Inco	Canada	170.0	1.8	61.5
18	Mitsui Mining & Smelting	Japan	160.5	1.7	63.2
19	Enami	Chile	160.0	1.7	64.9
20	MIM Holdings	Australia	150.0	1.6	66.5
21	AT&T Nassau Metals	United States	147.0	1.6	68.1
22	RTB Bor	Yugoslavia	145.0	1.5	69.6
23	Dowa Mining	Japan	142.2	1.5	71.2
24	RTZ	United Kingdom	125.4	1.3	72.5
25	Cobre de México	Mexico	120.0	1.3	73.8
26	Furukawa Mining	Japan	97.3	1.0	74.8
27	Hüttenwerke Kayser	Germany	90.0	1.0	75.8
28	Degussa	Germany	77.8	0.8	76.6
29	BICC Metals	United Kingdom	75.0	0.8	77.4
30	IMI	United Kingdom	75.0	0.8	78.2
	Others		2047.0	21.8	100.0
	Western world total		9387.2		

Source: UNCTAD secretariat, based on several sources.

(a) Includes refineries and SX-EW plants producing high-grade cathode.

Table 14
Largest copper refining companies of the Western world in 1990

	Company	Country of origin	Refining capacity (a) (000 tpy Cu)	Share of Western world (%)	cumulative
1	Codelco	Chile	1100.0	10.4	10.4
2	Phelps Dodge	United States	555.0	5.2	15.7
3	Asarco	United States	513.2	4.9	20.5
4	Mitsubishi	Japan	477.5	4.5	25.0
5	Zimco	Zambia	404.6	3.8	28.9
6	Magma	United States	385.0	3.6	32.5
7	Acec-Union Minière	Belgium	350.3	3.3	35.8
8	Nippon Mining	Japan	300.0	2.8	38.6
9	Gécamines	Zaire	290.0	2.7	41.4
10	MIM Holdings	Australia	289.7	2.7	44.1
11	RTZ	United Kingdom	257.3	2.4	46.6
12	Minero Perú	Peru	253.0	2.4	49.0
13	Brascan	Canada	240.6	2.3	51.2
14	Southwire	United States	235.0	2.2	53.5
15	Sumitomo	Japan	220.2	2.1	55.5
16	Enami	Chile	220.0	2.1	57.6
17	Lucky Goldstar	Korea, Republic of	200.0	1.9	59.5
18	Mitsui Mining & Smelting	Japan	183.9	1.7	61.2
19	Inco	Canada	179.0	1.7	62.9
20	Cyprus	United States	169.0	1.6	64.5
21	Anglo American	South Africa	166.3	1.6	66.1
22	RTB Bor	Yugoslavia	165.0	1.6	67.7
23	Caraíba Metais	Brazil	160.0	1.5	69.2
24	Cobre de México	Mexico	150.0	1.4	70.6
25	Nat. Iranian Copper Ind.	Iran, Isl. Rep. of	145.0	1.4	72.0
26	Stà. Metallurgica Italiana	Italy	140.0	1.3	73.3
27	Ind. Minera México	Mexico	134.1	1.3	74.6
28	Dowa Mining	Japan	130.2	1.2	75.8
29	Metallgesellschaft	Germany	128.0	1.2	77.0
30	Kuwait Investment Office	Kuwait	125.0	1.2	78.2
	Others		2305.5	21.8	100.0
	Western world total		10572.5		

Source: UNCTAD secretariat, based on several sources.

(a) Includes refineries and SX-EW plants producing high-grade cathode.

Table 15
Largest copper refining companies of the Western world in 2000 (projected)

	Company	Country of origin	Refining capacity (a) (000 tpy Cu)	Share of Western world (%)	cumulative
1	Codelco	Chile	1457.0	11.5	11.5
2	Phelps Dodge	United States	635.1	5.0	16.6
3	Asarco	United States	540.5	4.3	20.8
4	Mitsubishi	Japan	533.9	4.2	25.1
5	Zimco	Zambia	404.6	3.2	28.3
6	RTZ	United Kingdom	392.7	3.1	31.4
7	Gécamines	Zaire	390.0	3.1	34.4
8	Nippon Mining	Japan	362.4	2.9	37.3
9	Acec-Union Minière	Belgium	352.8	2.8	40.1
10	MIM Holdings	Australia	350.6	2.8	42.9
11	Magma	United States	320.0	2.5	45.4
12	Minero Perú	Peru	280.0	2.2	47.6
13	Brascan	Canada	242.0	1.9	49.5
14	Sumitomo	Japan	234.1	1.9	51.4
15	Enami	Chile	227.5	1.8	53.2
16	Lucky Goldstar	Korea, Republic of	227.4	1.8	55.0
17	Metallgesellschaft	Germany	227.1	1.8	56.8
18	Mitsui Mining & Smelting	Japan	209.7	1.7	58.4
19	Southwire	United States	205.0	1.6	60.1
20	Anigo American	South Africa	197.1	1.6	61.6
21	Nat. Iranian Copper Ind.	Iran, Isl. Rep. of	185.0	1.5	63.1
22	Inco	Canada	180.0	1.4	64.5
23	Cobre de México	Mexico	170.0	1.3	65.9
24	Cyprus	United States	167.0	1.3	67.2
25	RTB Bor	Yugoslavia	165.0	1.3	68.5
26	Caraíba Metais	Brazil	160.0	1.3	69.8
27	Ind. Minera México	Mexico	148.5	1.2	70.9
28	Stà. Metallurgica Italiana	Italy	140.0	1.1	72.0
29	Dowa Mining	Japan	135.9	1.1	73.1
30	Outokumpu	Finland	131.8	1.0	74.2
	Others		3267.4	25.8	100.0
	Western world total		12640.0		

Source: UNCTAD secretariat, based on several sources.

(a) Includes refineries and SX-EW plants producing high-grade cathode.

Table 16
Concentration in the Western unwrought copper industry, 1980-2000
(% of total Western world capacity controlled by largest companies)

Stage of processing	5 largest			10 largest			20 largest			30 largest		
	1980	1990	2000	1980	1990	2000	1980	1990	2000	1980	1990	2000
Mining	38.0	38.4	34.6	52.7	54.7	49.7	62.7	70.1	66.5	74.4	77.6	75.2
Smelting	31.4	28.1	27.6	48.4	43.9	43.6	67.2	63.9	63.1	77.6	78.8	76.6
Refining	31.5	28.9	28.3	47.7	44.1	42.9	66.5	64.5	61.6	78.2	78.2	74.2

Source: Tables 7 to 15 of this paper.

Table 17
Country of origin of copper mining companies and geographical distribution of their capacities (a)

	Share of Western world	% Cap owned: in home country	abroad	Share of Western world	% Cap owned: in home country	abroad	Share of Western world	% Cap owned: in home country	abroad
	1980			1990			2000		
WORLD (b)	**88.8**	**82.6**	**17.4**	**89.7**	**76.5**	**23.5**	**91.0**	**67.7**	**32.3**
Developed countries	**47.4**	**67.4**	**32.6**	**47.2**	**55.7**	**44.3**	**53.4**	**45.2**	**54.8**
America	**32.3**	**81.6**	**18.4**	**27.6**	**73.9**	**26.1**	**29.0**	**61.7**	**38.3**
Canada	5.9	96.6	3.4	4.1	90.0	10.0	6.5	61.0	39.0
United States	26.4	78.3	21.7	23.5	71.1	28.9	22.4	61.9	38.1
Europe (c)	**6.9**	**27.1**	**72.9**	**10.9**	**19.1**	**80.9**	**11.9**	**12.5**	**87.5**
Belgium	0.3	0.0	100.0	0.8	19.4	80.6	0.7	19.9	80.1
Finland	0.8	69.0	31.0	0.6	26.3	73.7	0.8	7.1	92.9
Germany	0.2	15.4	84.6	0.7	0.0	100.0	0.6	0.0	100.0
Netherlands	0.2	0.0	100.0	0.3	0.0	100.0	1.1	0.0	100.0
Norway	0.2	100.0	0.0	0.1	100.0	0.0	0.1	100.0	0.0
Portugal	0.1	100.0	0.0	1.0	100.0	0.0	0.7	100.0	0.0
Spain	0.3	100.0	0.0	0.0	100.0	0.0	0.0	100.0	0.0
Sweden	0.7	100.0	0.0	1.6	43.1	56.9	1.5	32.2	67.8
United Kingdom	4.2	0.3	99.7	5.7	0.2	99.8	6.3	0.0	100.0
South Africa	**4.3**	**15.3**	**84.7**	**3.1**	**28.3**	**71.7**	**3.4**	**16.8**	**83.2**
Asia	**1.3**	**45.6**	**54.4**	**1.3**	**9.7**	**90.3**	**1.7**	**5.6**	**94.4**
Japan	1.3	45.6	54.4	1.3	9.7	90.3	1.7	5.6	94.4
Oceania	**2.6**	**96.7**	**3.3**	**4.2**	**65.5**	**34.5**	**6.5**	**48.5**	**51.5**
Australia	2.6	96.7	3.3	4.2	65.5	34.5	6.5	48.5	51.5
Developing countries	**41.4**	**100.0**	**0.0**	**42.5**	**99.6**	**0.4**	**37.6**	**99.7**	**0.3**
America (c)	**18.6**	**100.0**	**0.0**	**21.7**	**100.0**	**0.0**	**20.6**	**100.0**	**0.0**
Brazil				0.5	100.0	0.0	0.4	100.0	0.0
Chile	14.6	100.0	0.0	16.4	100.0	0.0	16.3	100.0	0.0
Mexico	2.5	100.0	0.0	2.6	100.0	0.0	2.1	100.0	0.0
Peru	1.3	100.0	0.0	2.0	100.0	0.0	1.6	100.0	0.0

Table 17
Country of origin of copper mining companies and geographical distribution of their capacities (a)

	Share of Western world	% Cap owned: in home country	abroad	Share of Western world	% Cap owned: in home country	abroad	Share of Western world	% Cap owned: in home country	abroad
	1980			1990			2000		
Africa (c)	**15.1**	**100.0**	**0.0**	**12.6**	**100.0**	**0.0**	**9.0**	**100.0**	**0.0**
Morocco	0.1	100.0	0.0	0.2	100.0	0.0	0.1	100.0	0.0
Zaire	8.9	100.0	0.0	7.4	100.0	0.0	5.1	100.0	0.0
Zambia	5.9	100.0	0.0	4.8	100.0	0.0	3.5	100.0	0.0
Zimbabwe	0.2	100.0	0.0	0.1	100.0	0.0	0.0	100.0	0.0
Asia (c)	**5.8**	**100.0**	**0.0**	**6.4**	**97.1**	**2.9**	**6.6**	**98.3**	**1.7**
India	0.4	100.0	0.0	0.6	100.0	0.0	0.7	100.0	0.0
Indonesia	0.1	100.0	0.0	0.2	100.0	0.0	0.3	100.0	0.0
Iran, Isl Rep of	0.0	100.0	0.0	1.4	100.0	0.0	2.0	100.0	0.0
Malaysia	0.2	100.0	0.0	0.2	100.0	0.0			
Philippines	4.4	100.0	0.0	2.7	100.0	0.0	2.5	100.0	0.0
Turkey	0.6	100.0	0.0	0.7	100.0	0.0	0.7	100.0	0.0
Europe	**1.4**	**100.0**	**0.0**	**1.6**	**100.0**	**0.0**	**1.1**	**100.0**	**0.0**
Yugoslavia	1.4	100.0	0.0	1.6	100.0	0.0	1.1	100.0	0.0
Oceania	**0.4**	**100.0**	**0.0**	**0.2**	**100.0**	**0.0**	**0.3**	**100.0**	**0.0**
Papua New Guinea	0.4	100.0	0.0	0.2	100.0	0.0	0.3	100.0	0.0

Source: UNCTAD secretariat, based on several sources.

(a) Includes capacities of mines producing ore processed through the conventional method and through SX-EW.
(b) Total world share is not 100 because of the public's partial ownership of some companies.
(c) Regional totals do not correspond to the sum of countries because they include countries whose companies' capacities are not shown in the table.

Table 18
Country of origin of copper smelting companies and geographical distribution of their capacities (a)

	Share of Western world	% Cap owned: in home country	% Cap owned: abroad	Share of Western world	% Cap owned: in home country	% Cap owned: abroad	Share of Western world	% Cap owned: in home country	% Cap owned: abroad
	1980			1990			2000		
WORLD (b)	**92.4**	**88.9**	**11.1**	**93.6**	**83.7**	**16.3**	**94.3**	**81.9**	**18.1**
Developed countries	**63.8**	**84.0**	**16.0**	**58.1**	**76.6**	**23.4**	**58.5**	**71.7**	**28.3**
America	**29.1**	**86.9**	**13.1**	**22.0**	**83.0**	**17.0**	**22.1**	**77.8**	**22.2**
Canada	4.8	100.0	0.0	3.6	100.0	0.0	3.5	100.0	0.0
United States	24.4	84.3	15.7	18.4	79.7	20.3	18.6	73.6	26.4
Europe (c)	**14.6**	**79.2**	**20.8**	**15.5**	**63.1**	**36.9**	**16.1**	**57.1**	**42.9**
Austria	0.4	100.0	0.0	0.3	100.0	0.0	0.3	100.0	0.0
Belgium	1.2	94.2	5.8	1.9	77.4	22.6	1.7	78.6	21.4
Finland	0.7	97.4	2.6	1.0	100.0	0.0	1.1	100.0	0.0
France	0.4	18.0	82.0	0.1	100.0	0.0	0.1	100.0	0.0
Germany	5.6	98.1	1.9	4.0	88.9	11.1	4.3	70.8	29.2
Italy	0.3	100.0	0.0	1.5	35.3	64.7	1.3	36.1	63.9
Spain	1.2	100.0	0.0	0.3	100.0	0.0	0.5	100.0	0.0
Sweden	1.1	100.0	0.0	1.7	59.7	40.3	2.0	46.0	54.0
United Kingdom	3.5	27.7	72.3	4.1	23.1	76.9	4.3	23.5	76.5
South Africa	**3.3**	**7.8**	**92.2**	**2.4**	**26.6**	**73.4**	**2.2**	**25.0**	**75.0**
Asia	**14.5**	**98.2**	**1.8**	**14.7**	**92.2**	**7.8**	**13.9**	**86.7**	**13.3**
Japan	14.5	98.2	1.8	14.7	92.2	7.8	13.9	86.7	13.3
Oceania	**2.2**	**100.0**	**0.0**	**3.5**	**65.5**	**34.5**	**4.1**	**71.5**	**28.5**
Australia	2.2	100.0	0.0	3.5	65.5	34.5	4.1	71.5	28.5
Developing countries	**28.6**	**100.0**	**0.0**	**35.4**	**95.6**	**4.4**	**35.7**	**98.6**	**1.4**
America (c)	**12.5**	**100.0**	**0.0**	**17.1**	**100.0**	**0.0**	**17.6**	**100.0**	**0.0**
Brazil				1.7	100.0	0.0	1.5	100.0	0.0
Chile	10.7	100.0	0.0	12.7	100.0	0.0	13.5	100.0	0.0
Mexico	0.9	100.0	0.0	1.9	100.0	0.0	2.1	100.0	0.0
Peru	0.8	100.0	0.0	0.7	100.0	0.0	0.6	100.0	0.0
Africa (c)	**10.5**	**100.0**	**0.0**	**8.9**	**100.0**	**0.0**	**9.4**	**100.0**	**0.0**
Zaire	5.9	100.0	0.0	5.2	100.0	0.0	5.5	100.0	0.0
Zambia	4.4	100.0	0.0	3.5	100.0	0.0	3.6	100.0	0.0

Table 18
Country of origin of copper smelting companies and geographical distribution of their capacities (a)

	Share of Western world	% Cap owned: in home country	% Cap owned: abroad	Share of Western world	% Cap owned: in home country	% Cap owned: abroad	Share of Western world	% Cap owned: in home country	% Cap owned: abroad
	1980			1990			2000		
Asia (c)	**3.7**	**100.0**	**0.0**	**7.5**	**79.4**	**20.6**	**7.0**	**92.7**	**7.3**
India	0.6	100.0	0.0	0.5	100.0	0.0	1.3	100.0	0.0
Iran, Isl Rep of				1.5	100.0	0.0	1.3	100.0	0.0
Korea, Republic of	1.7	100.0	0.0	2.1	100.0	0.0	1.8	100.0	0.0
Kuwait				1.5	0.0	100.0	0.5	0.0	100.0
Philippines				0.6	100.0	0.0	0.7	100.0	0.0
Taiwan, Prov China	0.8	100.0	0.0	0.2	100.0	0.0			
Thailand							0.6	100.0	0.0
Turkey	0.6	100.0	0.0	0.6	100.0	0.0	0.3	100.0	0.0
Europe	**1.9**	**100.0**	**0.0**	**1.9**	**100.0**	**0.0**	**1.7**	**100.0**	**0.0**
Yugoslavia	1.9	100.0	0.0	1.9	100.0	0.0	1.7	100.0	0.0

Source: UNCTAD secretariat, based on several sources.

(a) Includes capacities of smelters and SX-EW plants producing low-grade cathode.
(b) Total world share is not 100 because of the public's partial ownership of some companies.
(c) Regional totals do not correspond to the sum of countries because they include countries whose companies' capacities are not shown in the table.

Table 19
Country of origin of copper refining companies and geographical distribution of their capacities (a)

	Share of Western world	% Cap owned: in home country	abroad	Share of Western world	% Cap owned: in home country	abroad	Share of Western world	% Cap owned: in home country	abroad
	1980			1990			2000		
WORLD (b)	**94.0**	**94.1**	**5.9**	**93.9**	**88.3**	**11.7**	**93.9**	**83.6**	**16.4**
Developed countries	**69.8**	**92.1**	**7.9**	**58.9**	**83.5**	**16.5**	**57.8**	**74.4**	**25.6**
America	**33.7**	**98.9**	**1.1**	**23.2**	**97.3**	**2.7**	**22.5**	**86.7**	**13.3**
Canada	4.3	92.6	7.4	4.0	97.4	2.6	4.5	72.5	27.5
United States	29.4	99.9	0.1	19.2	97.2	2.8	18.0	90.2	9.8
Europe (c)	**18.8**	**85.4**	**14.6**	**17.4**	**75.0**	**25.0**	**16.9**	**63.3**	**36.7**
Austria	0.4	100.0	0.0	0.2	100.0	0.0	0.2	100.0	0.0
Belgium	5.5	97.3	2.7	3.9	98.6	1.4	3.3	98.6	1.4
Finland	0.5	96.8	3.2	0.7	84.6	15.4	1.0	53.1	46.9
France	0.6	51.7	48.3	0.3	100.0	0.0	0.3	100.0	0.0
Germany	5.3	100.0	0.0	4.0	93.7	6.3	4.1	76.2	23.8
Italy	0.5	76.7	23.3	2.1	53.1	46.9	1.9	57.7	42.3
Portugal	0.1	100.0	0.0						
Spain	1.5	100.0	0.0	0.9	100.0	0.0	0.8	100.0	0.0
Sweden	0.7	100.0	0.0	1.1	82.6	17.4	1.0	81.6	18.4
United Kingdom	3.8	42.8	57.2	4.2	33.8	66.2	4.3	16.4	83.6
South Africa	**2.2**	**7.4**	**92.6**	**1.7**	**28.8**	**71.2**	**1.6**	**24.5**	**75.5**
Asia	**13.6**	**97.3**	**2.7**	**13.6**	**81.1**	**18.9**	**13.0**	**76.7**	**23.3**
Japan	13.6	97.3	2.7	13.6	81.1	18.9	13.0	76.7	23.3
Oceania	**1.6**	**100.0**	**0.0**	**3.1**	**68.6**	**31.4**	**3.8**	**64.2**	**35.8**
Australia	1.6	100.0	0.0	3.1	68.6	31.4	3.8	64.2	35.8
Developing countries	**24.1**	**100.0**	**0.0**	**34.8**	**96.6**	**3.4**	**36.0**	**98.7**	**1.3**
America (c)	**12.7**	**100.0**	**0.0**	**19.3**	**100.0**	**0.0**	**20.7**	**100.0**	**0.0**
Brazil	0.1	100.0	0.0	1.6	100.0	0.0	1.3	100.0	0.0
Chile	8.7	100.0	0.0	12.6	100.0	0.0	13.5	100.0	0.0
Mexico	1.3	100.0	0.0	2.7	100.0	0.0	3.5	100.0	0.0
Peru	2.5	100.0	0.0	2.4	100.0	0.0	2.3	100.0	0.0

Table 19
Country of origin of copper refining companies and geographical distribution of their capacities (a)

	Share of Western world	% Cap owned: in home country	% Cap owned: abroad	Share of Western world	% Cap owned: in home country	% Cap owned: abroad	Share of Western world	% Cap owned: in home country	% Cap owned: abroad
	1980			1990			2000		
Africa (c)	**6.3**	**100.0**	**0.0**	**6.7**	**100.0**	**0.0**	**6.4**	**100.0**	**0.0**
Zaire	1.8	100.0	0.0	2.7	100.0	0.0	3.1	100.0	0.0
Zambia	4.5	100.0	0.0	3.8	100.0	0.0	3.2	100.0	0.0
Asia (c)	**3.6**	**100.0**	**0.0**	**7.1**	**83.4**	**16.6**	**7.6**	**93.9**	**6.1**
India	0.5	100.0	0.0	0.4	100.0	0.0	1.3	100.0	0.0
Iran, Isl Rep of				1.4	100.0	0.0	1.5	100.0	0.0
Korea, Republic of	1.6	100.0	0.0	1.9	100.0	0.0	1.8	98.9	1.1
Kuwait				1.2	0.0	100.0	0.4	0.0	100.0
Philippines				0.5	100.0	0.0	0.6	100.0	0.0
Taiwan, Prov China	0.6	100.0	0.0	0.2	100.0	0.0	0.0	100.0	0.0
Thailand							0.5	100.0	0.0
Turkey	0.9	100.0	0.0	1.3	100.0	0.0	1.2	100.0	0.0
Europe	**1.5**	**100.0**	**0.0**	**1.7**	**100.0**	**0.0**	**1.4**	**100.0**	**0.0**
Yugoslavia	1.5	100.0	0.0	1.7	100.0	0.0	1.4	100.0	0.0

Source: UNCTAD secretariat, based on several sources.

(a) Includes capacities of refineries and SX-EW plants producing high-grade cathode.
(b) Total world share is not 100 because of the public's partial ownership of some companies.
(c) Regional totals do not correspond to the sum of countries because they include countries whose companies' capacities are not shown in the table.

Table 20
Main privatization transactions in the copper industry

Country	Company/ plant	Production capacity (ktpy Cu)	Acquirer	Date
Argentina	Bajo la Alumbrera (deposit)	70 (M)	Musto Exploration	1992
Austria	Montanwerke Brixlegg	60 (S), 50 (R)	Metallgesellschaft (25.5%), MIM Holdings (25.5%)	1990
Brazil	Caraíba Metais	160 (S), 160 (R)	Paraibuna Metais, Banco da Bahia, Arbi (22% each)	1988
	Salobo (deposit)	100 (M)	AAC + Banco Bozano (50%)	1993
Korea, Rep of	Onsan Copper Refinery	80 (S), 80 (R)	Lucky Metals Corp (ultimately 100%)	1982
Mexico	Cobre de México	150 (R)	Impulsora de Cobre (36.7%), Banco Internacional (15%)	1991
	Mexicana de Cananea	125 (M), 72 (S)	Ind Min México (51%) Acec-Union-Minière (49%)	1990
	Mexicana de Cobre	150 (M), 150 (S), 180 (R)	Ind Min México	1988
Peru	Cerro Verde	33 (M)	Cyprus	1993
	Condestable	5.3 (M)	Prodebolsa (80%), employees (20%)	1992
	Quellaveco (deposit)	25 (M)	Mantos Minorco (AAC group)	1992

Source: UNCTAD, based on press articles.

M - mining, S - smelting, R - refining

Table 21
Mine production of copper by regions
(thousand tons and %)

	1980-1982	Share (% of world)	Growth rate since 1970-72 (% pa)	1990-1992	Share (% of world)	Growth rate since 1980-82 (% pa)
WORLD	**8063.9**	**100.0**	**2.0**	**9124.3**	**100.0**	**1.2**
Developed market-economy countries	**2635.2**	**32.7**	**-0.4**	**3251.9**	**35.6**	**2.1**
America	1962.2	24.3	-0.9	2438.8	26.7	2.2
Europe	168.5	2.1	2.3	276.4	3.0	5.1
South Africa	209.9	2.6	3.0	194.5	2.1	-0.8
Asia	54.6	0.7	-8.2	12.5	0.1	-13.7
Oceania	240.0	3.0	3.3	329.7	3.6	3.2
Developing countries and territories	**3716.3**	**46.1**	**3.7**	**4115.6**	**45.1**	**1.0**
America	1787.4	22.2	5.9	2450.0	26.9	3.2
Africa	1184.7	14.7	0.0	777.9	8.5	-4.1
Asia	467.7	5.8	6.4	597.0	6.5	2.5
Europe	115.7	1.4	1.9	101.4	1.1	-1.3
Oceania	160.7	2.0	14.5	189.4	2.1	1.7
Countries in Eastern Europe	**1460.2**	**18.1**	**2.0**	**1275.9**	**14.0**	**-1.3**
Socialist countries of Asia	**252.3**	**3.1**	**7.6**	**481.0**	**5.3**	**6.7**

Table 22
Largest mine copper producing countries
(% of world total)

1980-1982		1990-1992	
United States	16.0	Chile	19.5
Chile	14.9	United States	18.2
USSR	12.4	USSR/CIS	9.3
Canada	8.4	Canada	8.5
Zambia	7.2	Zambia	4.9
Zaire	6.2	Peru	3.9
Peru	4.3	Poland	3.8
Poland	4.2	China	3.7
Philippines	3.7	Australia	3.6
Australia	3.0	Mexico	3.1
Total	80.3	**Total**	78.5

Source: Metallgesellschaft, Metal Statistics.

Table 23
World mine capacity trends
(thousand metric tons, recoverable copper)

Area and type of mine capacity	1993	% of world total	% of reg total	1997	% of world total	% of reg total	2005	% of world total	% of reg total
Africa	**1175**	**10.6**		**1170**	**9.5**		**1187**	**8.6**	
SX-EW	293	25.3	24.9	353	20.7	30.2	338	20.5	28.5
Other	882	8.9	75.1	817	7.7	69.8	849	7.0	71.5
Asia/Middle East	**1467**	**13.2**		**1815**	**14.7**		**2081**	**15.1**	
SX-EW	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0
Other	1467	14.8	100.0	1815	17.0	100.0	2081	17.1	100.0
Europe	**1758**	**15.9**		**1842**	**14.9**		**2030**	**14.7**	
SX-EW	1	0.1	0.1	1	0.1	0.1	0	0.0	0.0
Other	1757	17.7	99.9	1841	17.3	99.9	2030	16.7	100.0
Oceania	**587**	**5.3**		**578**	**4.7**		**727**	**5.3**	
SX-EW	21	1.8	3.6	27	1.6	4.7	3	0.2	0.4
Other	566	5.7	96.4	551	5.2	95.3	724	6.0	99.6
North America	**3398**	**30.7**		**3659**	**29.6**		**3722**	**27.0**	
SX-EW	585	50.4	17.2	715	41.9	19.5	600	36.5	16.1
Other	2813	28.3	82.8	2944	27.6	80.5	3122	25.7	83.9
South America	**2699**	**24.4**		**3296**	**26.7**		**4056**	**29.4**	
SX-EW	260	22.4	9.6	609	35.7	18.5	705	42.8	17.4
Other	2439	24.6	90.4	2687	25.2	81.5	3351	27.6	82.6
World	**11084**	**100.0**		**12360**	**100.0**		**13803**	**100.0**	
SX-EW	**1160**	**100.0**	**10.5**	**1705**	**100.0**	**13.8**	**1646**	**100.0**	**11.9**
Other	**9924**	**100.0**	**89.5**	**10655**	**100.0**	**86.2**	**12157**	**100.0**	**88.1**

Source: USBM, Minerals Yearbook 1991.

Table 24
Production of unrefined copper by regions
(thousand tons and %)

	1980-1982	Share (% of world)	Growth rate since 1970-72 (% pa)	1990-1991	Share (% of world)	Growth rate since 1980-82 (% pa)
WORLD	**7856.5**	**100.0**	**1.8**	**8735.0**	**100.0**	**1.1**
Developed market-economy countries	**3245.7**	**41.3**	**0.5**	**3526.5**	**40.4**	**0.9**
America	1550.5	19.7	-2.1	1675.5	19.2	0.8
Europe	410.8	5.2	3.8	515.6	5.9	2.4
South Africa	187.7	2.4	1.6	151.6	1.7	-2.2
Asia	922.6	11.7	4.5	989.3	11.3	0.7
Oceania	174.2	2.2	2.7	194.5	2.2	1.2
Developing countries and territories	**2765.2**	**35.2**	**2.4**	**3369.8**	**38.6**	**2.1**
America	1383.7	17.6	4.7	1939.4	22.2	3.6
Africa	1111.0	14.1	-0.5	795.6	9.1	-3.5
Asia	180.5	2.3	16.4	518.5	5.9	11.7
Europe	90.1	1.1	-1.2	116.4	1.3	2.7
Countries in Eastern Europe	**1629.9**	**20.7**	**3.2**	**1386.3**	**15.9**	**-1.7**
Socialist countries of Asia	**215.7**	**2.7**	**5.9**	**452.5**	**5.2**	**8.1**

Table 25
Largest unrefined copper producing countries
(% of world total)

1980-1982		1990-1991	
USSR	14.5	Chile	15.0
United States	14.0	United States	13.1
Chile	12.5	Japan	11.3
Japan	11.7	USSR/CIS	10.9
Zambia	7.5	Canada	6.1
Zaire	5.8	Zambia	5.0
Canada	5.7	China	4.9
Poland	4.5	Poland	4.0
Peru	4.1	Zaire	3.5
China	2.4	Peru	3.5
Total	82.7	**Total**	77.3

Source: Metallgesellschaft, Metal Statistics.

Table 26
Production of refined copper by regions
(from primary and secondary sources, thousand tons and %)

	1980-1982	Share (% of world)	Growth rate since 1970-72 (% pa)	1990-1992	Share (% of world)	Growth rate since 1980-82 (% pa)
WORLD	**9443.2**	**100.0**	**2.1**	**10760.0**	**100.0**	**1.3**
Developed market-economy countries	**4958.5**	**52.5**	**0.8**	**5569.2**	**51.8**	**1.2**
America	2242.3	23.7	-0.9	2584.6	24.0	1.4
Europe	1340.8	14.2	1.4	1484.2	13.8	1.0
South Africa	145.1	1.5	6.4	125.3	1.2	-1.5
Asia	1046.5	11.1	3.5	1081.7	10.1	0.3
Oceania	183.8	1.9	1.4	293.3	2.7	4.8
Developing countries and territories	**2246.8**	**23.8**	**3.8**	**3000.0**	**27.9**	**2.9**
America	1163.9	12.3	7.2	1769.2	16.4	4.3
Africa	761.4	8.1	-0.7	563.3	5.2	-3.0
Asia	191.2	2.0	17.1	547.3	5.1	11.1
Europe	130.3	1.4	2.3	120.2	1.1	-0.8
Countries in Eastern Europe	**1913.9**	**20.3**	**3.2**	**1625.4**	**15.1**	**-1.6**
Socialist countries of Asia	**324.0**	**3.4**	**7.0**	**565.3**	**5.3**	**5.7**

Table 27
Largest refined copper producing countries
(% of world total)

1980-82		1990-92	
United States	19.1	United States	19.1
USSR	14.0	Chile	11.4
Japan	11.1	USSR/CIS	10.8
Chile	8.6	Japan	10.1
Zambia	6.2	China	5.0
Canada	4.7	Canada	4.9
Belgium	4.5	Germany	4.9
Germany	4.1	Zambia	3.9
Poland	3.6	Poland	3.4
China	3.2	Belgium	2.9
Total	60.0	**Total**	76.3

Source: Metallgesellschaft, Metal Statistics.

Table 28
Regional distribution of Western smelting and refining capacity
(% of Western total)

	Smelters			Refineries			Refineries + SX-EW plants		
	1980	1990	2000 (projected)	1980	1990	2000 (projected)	1980	1990	2000 (projected)
North America	31.7	24.3	23.6	37.6	27.0	25.2	38.1	29.3	25.8
Latin America	16.4	21.8	22.3	12.8	20.5	20.4	13.2	20.7	26.9
Europe	14.1	16.0	14.4	19.8	20.1	18.3	18.9	18.5	15.2
Africa	17.0	14.5	14.6	10.0	10.2	10.2	10.9	10.9	9.8
Asia	18.2	20.4	21.4	17.6	19.3	22.5	16.8	17.8	19.1
Australia	2.6	3.0	3.7	2.2	3.0	3.4	2.1	2.8	3.2
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: UNCTAD, based on several sources.

Table 29
Major changes to production capacity for Western copper mines (a), 1993-1997

Country/Operation	Owner(s)	Capacity in 1993 (ktpy Cu)	Change until 1997 (ktpy Cu)	Effective date	Remarks
Argentina					
Bajo la Alumbrera	Musto Exploration	-	+ 110.0	1996	New mine
Australia					
Horseshoe	Barrack Mines	13.5	-13.5	1995	Shutdown due to reserve exhaustion
Cobar	CRA (RTZ)	22	-22.0	1994	Shutdown due to reserve exhaustion
Starra (Selwyn)	Cyprus Elders Hudspeth	15	-15.0	1995	Shutdown due to reserve exhaustion
Benambra	Macquarie Resources	-	+ 17.0	1994	New mine
Northparkes	North Broken Hill Peko	-	+ 10.0	1996	New mine
Nifty	Western Mining Corp.	-	+ 17.0	1994	New SX-EW plant
Olympic Dam	Western Mining Corp.	65.5	+ 18.5	1996	Expansion
Mount Lyell	Renison Goldfields Cons.	22	-22.0	1995	Shutdown due to reserve exhaustion
Brazil					
Jaguariri	Cia Brasileira do Cobre	20	-20.0	1996	Shutdown due to reserve exhaustion
Canada					
Highland Valley	Cominco Rio Algom Teck Corp. Highmont Mining	180	-10.0	1996	Capacity reduction
Louvicourt	Novicourt Aur Resources Teck Corp.	-	+ 50.0	1995	New mine
Geco Horne	Noranda	20.5	-20.5	1995	Shutdown due to reserve exhaustion
Island Copper	BHP - Utah Mines	56	-56.0	1997	Shutdown due to reserve exhaustion

Table 29
Major changes to production capacity for Western copper mines (a), 1993-1997

Country/Operation	Owner(s)	Capacity in 1993 (ktpy Cu)	Change until 1997 (ktpy Cu)	Effective date	Remarks
Chile					
Carolina de Michilla	Antofagasta Hldgs.	30	+ 10.0	1994	Expansion
El Lince	Antofagasta	25	+ 30.0	1995	SX-EW; expansion
	Outokumpu				
El Teniente Dump	Aurex	-	+ 14.0	1995	New operation
Huinquintipa	Billiton	-	+ 15.0	1996	New SX-EW plant
	Falconbridge				
	Chevron				
Crater Lixiviation	Codelco	-	+ 24.0	1997	New SX-EW plant
Chuquicamata	Codelco	550	+ 30.0	1995	Expansion
Oxidos	Codelco	-	+ 20.0	1994	New SX-EW plant
Quebrada M	Codelco	10	+ 20.0	1993	New mine
Radomiro Tomic	Codelco	-	+ 95.0	1997?	New SX-EW plant
Andacollo	Enami	-	+ 30.0	1997	New mine
Quebrada Blanca	Cominco	-	+ 75.0	1995	New SX-EW plant
	Teck Corp.				
	Pudahuel				
	Enami				
Leonor	Equatorial Mining	-	+ 20.0	1995	New SX-EW plant
Escondida	BHP - Utah Minerals	390	+ 90?	1995	Mine expansion (+10) +
	RTZ				new SX-EW plant (+80)
	Jeco				(latter unsure)
Mantos Blancos	Mantos Blancos (AAC)	-	+ 16.0	1995	New SX-EW plant
Manto Verde	Mantos Blancos (AAC)	-	+ 20.0	1995	New SX-EW plant
Zaldivar	Outokumpu	-	+ 100.0	1995	New SX-EW plant
	Placer Dome				
La Candelaria	Phelps Dodge	-	+ 105.0	1996	New mine
	Sumitomo				
La Cascada	Pudahuel	15	-15.0	1994	Shutdown
Lo Aguirre	Pudahuel	16	-16.0	1995	SX-EW; shutdown
Ivan-Zar	Rayrock	-	+ 10.5	1994	New SX-EW plant
Cerro Colorado	Rio Algom	-	+ 40.0	1994	New SX-EW plant
Indonesia					
Ertsberg-Grasberg	Freeport McMoRan	283.5	+ 66.5	1997	Continuous
	State of Indonesia				expansion

Table 29
Major changes to production capacity for Western copper mines (a), 1993-1997

Country/Operation	Owner(s)	Capacity in 1993 (ktpy Cu)	Change until 1997 (ktpy Cu)	Effective date	Remarks
Iran, Isl. Rep. of					
Meydouk	Nat. Iranian Copper Ind.	-	+ 42.0	1996	New mine
Sar Cheshmeh	Nat. Iranian Copper Ind.	120	+ 60.0	1996	Mine expansion (+20) + new SX-EW plant (+60)
Malaysia					
Mamut Ranau	OMRD State of Sabah	28.5	-28.5	1996	Shutdown due to reserve exhaustion
Mauritania					
Akjoujt	Arab Mining	0	+ 16.0	1996?	New orebody
Mexico					
Santo Tomas	Exall Resources	-	+ 10.0	1995	New SX-EW plant
Cananea	IMMSA Acec-Union Minière	125	+ 15.0	1996	Expansion
La Caridad	IMMSA	-	+ 18.0	1995	New SX-EW plant
María	Frisco Cominco	19	-9.0	1995-96	Shutdown of mine in 1995 (-19) + new SX-EW plant in 1996 (+10)
Morocco					
El Bleida	BRPM	15.7	-15.7	1995	Shutdown
Namibia					
Tchudi	Gold Field South Africa	-	+ 10.0	1995	New mine
Tsumeb	Gold Field South Africa	16	-16.0	1995	Shutdown
Peru					
Tintaya	Ematinsa Intl Finance Corp.	-	+ 12.0	1994	New SX-EW plant
Quellaveco	Mantos Blancos (AAC) Intl. Finance Corp.	-	+ 25.0	1995	New mine
Toquepala	Asarco Cerro Marmon Phelps Dodge Newmont	-	+ 20.0	1995	New SX-EW plant

Table 29
Major changes to production capacity for Western copper mines (a), 1993-1997

Country/Operation	Owner(s)	Capacity in 1993 (ktpy Cu)	Change until 1997 (ktpy Cu)	Effective date	Remarks
Philippines					
Taysan	Gwalia Consolidated Taysan Copper	-	+ 60.0	1997	New mine
Lepanto - Mankayan	Lepanto Co.	12	-12.0	1995	Shutdown due to reserve exhaustion
Lepanto - Far South East	Lepanto Co. CRA (RTZ)	-	+ 30.0	1997	New mine
Tapian/San Antonio	Placer Dome Performance Investment	28	+ 10.0	1994	Expansion
South Africa					
Palabora	RTZ Anglo American	127.5	-10.5	1995	Capacity reduction
Phalaborwa (Foskor)	Foskor	22	-12.0	1996	Capacity reduction
Sweden					
Viscaria	Outokumpu	12	-12.0	1994	Shutdown
Turkey					
Çayeli	Metall Mining Corp. Etibank	-	+ 21.0	1994	New mine
United States					
Ray	Asarco	130	+ 25.0	1995	Expansion
Silver Bell	Asarco	5	+ 11.3	1995	SX-EW; expansion
Troy	Asarco	12	-12.0	1994	Shutdown due to reserve exhaustion
Sanchez	Azco Magma	-	+ 25.0	1994	SX-EW
Bald Mountain	Boliden	0	+ 20.0	1995	Reopening of mine
Carlota	Cambior	-	+ 21.0	1995	New SX-EW plant
Bingham Canyon	Kennecott (RTZ)	-	+ 30.0	1995	New SX-EW plant
Flambeau (Ladysmith)	Kennecott (RTZ)	27	-	1993	New mine
Robinson	Magma	-	+ 60.0	1995	New mine
San Manuel	Magma	70	-70.0	1997	SX-EW; shutdown
Montanore	Noranda	40	+ 10.0	1994	Expansion
Chino	Phelps Dodge	116	-16.0	1994	Capacity reduction
Morenci	Mitsubishi Phelps Dodge Sumitomo	155	+ 15.0	1994	SX-EW; expansion

Table 29

Major changes to production capacity for Western copper mines (a), 1993-1997

Country/Operation	Owner(s)	Capacity in 1993 (ktpy Cu)	Change until 1997 (ktpy Cu)	Effective date	Remarks
Zaire					
Kipushi	Gécamines	30.5	-30.5	1995	Shutdown
Dikuluwe/Mashamba	Gécamines	174	-24	1994	Capacity reduction
Kamoto UG	Gécamines	147.5	+ 12.5	1994?	Expansion
Musoshi	Gécamines (Sodimiza)	24.3	-24.3	1995	Shutdown
Zambia					
Baluba	ZCCM	39.5	+ 10.5	1996	Expansion
Mufulira	ZCCM	75	-10.0	1995	Capacity reduction
Nkana UG	ZCCM	53	+ 12.0	1996	Expansion

Source: UNCTAD secretariat, based on several sources.

(a) Includes mines producing ore processed through the conventional method and through SX-EW.

Table 30
Major changes to production capacity for Western copper smelters, 1993-1997

Country/Operation	Owner(s)	Capacity in 1993 (ktpy Cu)	Change until 1997 (ktpy Cu)	Effective date	Remarks
Canada					
Copper Cliff	Inco	170.0	+ 15.0	1994	Expansion
Chile					
Chagres	Exxon	50.0	+ 60.0	1995	Expansion
Rungue (La Negra)	Refimet	40.0	+ 100.0	1995	Expansion following start-up in 1993
Finland					
Harjavalta	Outokumpu	95.0	+ 25.0	1996	Expansion
India					
Khetri	Hindustan Copper Ltd.	31.0	+ 34.0?	1995?	Expansion
Ratnagiri	Sterlite Industries	-	+ 30.0	1994	New smelter
Indonesia					
Gresik	Metallgesellschaft Freeport McMoRan Nippon Mining Petrokimia Gresik	-	+ 130.0	1996?	New smelter
Philippines					
Pasar	State of Philippines Marubani Sumitomo C. Itoh Intl. Finance Corp.	172.5	-	1993	Expansion (+ 34.5) completed in 1993
Spain					
Huelva	Freeport McMoRan Erzros (KIO)	145.0	+ 15.0	1995	Expansion
Thailand					
Rayong	Padaeng Industry Co. Mitsubishi MIM Holdings Marc Rich Mitsui	-	+ 100.0	1996?	New smelter

Table 30
Major changes to production capacity for Western copper smelters, 1993-1997

Country/Operation	Owner(s)	Capacity in 1993 (ktpy Cu)	Change until 1997 (ktpy Cu)	Effective date	Remarks
United States					
Miami (Inspiration)	Cyprus	150.0	+ 25.0	1994	Expansion
Garfield	Kennecott (RTZ)	200.0	+ 73.0	1995	Expansion
San Manuel	Magma	295.0	+ 30.0	1994	Expansion
Zaire					
Lulu P2	Gécamines	-	+ 100.0	1996?	New smelter; start-up has already been put off several years

Source: UNCTAD secretariat, based on several sources.

Table 31
Major changes to Western copper refinery production capacity, 1993-1997

Country/Operation	Owner(s)	Capacity in 1993 (ktpy Cu)	Change until 1997 (ktpy Cu)	Effective date	Remarks
Australia					
Townsville	MIM Holdings	210.0	+ 10.0	1994	Expansion
India					
Khetri	Hindustan Copper Ltd.	45.0	+ 20.0	1996	Expansion
Ratnagiri	Sterlite Industries	-	+ 80.0	1994	New refinery
Indonesia					
Gresik	Metallgesellschaft Freeport McMoRan Nippon Mining Petrokimia Gresik	-	+ 130.0	1996?	New refinery
Mexico					
Mexico	Cobre de Mexico	150.0	+ 20.0	1994	Expansion
Pasteje (Toluca)	Industrias Unidas	60.0	+ 60.0	1994-96	Ongoing expansion
Philippines					
Pasar	State of Philippines Marubeni Sumitomo C. Itoh Intl. Finance Corp.	172.5	-	1993	Expansion (+ 34.5) completed in 1993
Spain					
Huelva	Freeport McMoRan Ercros	135.0	+ 25.0	1995	Expansion
Thailand					
Rayong	Padaeng Industry Co. Mitsubishi MIM Holdings Marc Rich Mitsui	-	+ 100.0	1996?	New refinery
United States					
Garfield	Kennecott (RTZ)	200.0	+ 73.0	1995	Expansion
Zaire					
Lulu P2	Gécamines	-	+ 100.0	1996?	New refiney; start-up has already been put off several years

Source: UNCTAD, based on several sources.

Table 32
Largest net exporters of unwrought copper, 1980-1982
(%, unless otherwise specified)

	Total net exports (ktpy Cu)	Share of world exports (a)	Composition of exports: concen-trates	unrefined	refined
Chile	1085.1	20.6	13.5	15.9	70.7
Zambia	592.0	11.2		0.2	99.8
Canada	515.4	10.5	49.1	0.9	50.0
Zaire	479.9	9.1	7.3	60.7	32.0
Philippines	286.7	5.5	100.0		
Peru	268.5	5.1	9.3	31.7	59.0
Pap. New Guinea	161.2	3.1	100.0		
Poland	154.6	2.9			100.0
Mexico	125.5	2.4	93.8	5.5	0.7
South Africa	113.7	2.3	18.2	32.1	49.7
World		**100.0**	**27.7**	**14.2**	**58.1**

Source: UNCTAD secretariat.

(a) Countries have been ranked according to net exports (exports - imports), but shares refer only to total unwrought exports.

Table 33
Largest net exporters of unwrought copper, 1990-1992
(%, unless otherwise specified)

	Total net exports (ktpy Cu)	Share of world exports (a)	Composition of exports: concen-trates	unrefined	refined
Chile	1725.3	25.3	26.5	6.2	67.3
Canada	640.6	10.8	48.4	2.0	49.6
Zambia	405.5	6.2			100.0
Peru	346.5	5.1	11.9	27.1	61.0
Zaire	255.0	3.7	5.7	51.7	42.6
Australia	246.2	3.6	25.6	2.5	71.9
Poland	191.1	2.8			100.0
Pap. New Guinea	173.1	2.5	100.0		
Indonesia	167.2	3.2	99.9		0.1
Portugal	149.9	2.6	99.8		0.2
World		**100.0**	**32.8**	**8.5**	**58.7**

Source: UNCTAD secretariat

(a) Countries have been ranked according to net exports (exports - imports), but shares refer only to total unwrought exports.

Table 34
Largest net importers of unwrought copper, 1980-82
(%, unless otherwise specified)

	Total net imports (ktpy Cu)	Share of world imports (a)	Composition of imports: concentrates	unrefined	refined
Japan	1131.2	22.7	73.1	6.2	20.7
Germany	567.1	12.2	21.0	10.0	69.0
France	393.2	7.6	0.0	4.7	95.3
Italy	343.0	6.4	0.0	0.4	99.6
United States	322.8	9.2	11.1	15.2	73.7
United Kingdom	293.0	5.9	0.0	21.9	78.0
Belgium	194.1	9.2	2.4	68.2	29.5
Brazil	185.6	3.5	0.5	3.8	95.7
China	173.9	3.2	13.5	20.8	65.7
Korea, Rep of	117.1	2.3	79.9	1.5	18.5
World		**100.0**	**27.0**	**14.4**	**58.6**

Source: UNCTAD secretariat.

(a) Countries have been ranked according to net imports (imports - exports), but shares refer only to total unwrought imports.

Table 35
Largest net importers of unwrought copper, 1990-1992
(%, unless otherwise specified)

	Total net imports (ktpy Cu)	Share of world imports (a)	Composition of imports: concentrates	unrefined	refined
Japan	1431.6	22.3	62.3	2.0	35.7
Germany	730.5	11.8	19.3	7.0	73.7
France	430.4	6.7	0.2	3.6	96.2
Italy	424.6	6.5	0.2	0.4	99.4
Taiwan, Pr. China	363.0	5.3	0.3		99.7
Korea, Rep. of	278.2	4.2	32.7	15.6	51.7
United Kingdom	263.5	4.3	0.1	11.7	88.2
China	257.3	3.9	33.4	15.1	51.4
Belgium	220.5	6.2	0.7	41.5	57.9
Brazil	128.2	2.6	61.5	2.4	36.1
World		**100.0**	**29.5**	**8.6**	**61.9**

Source: UNCTAD secretariat.

(a) Countries have been ranked according to net imports (imports - exports), but shares refer only to total unwrought imports.

Table 36
Exports of copper ore and concentrates by regions
(thousand tons and %)

	1980-1982	Share (% of world)	Growth rate since 1970-72 (% pa)	1990-1992	Share (% of world)	Growth rate since 1980-82 (% pa)
WORLD	**1461.1**	**100.0**	**7.4**	**2235.0**	**100.0**	**4.3**
Developed market-economy countries	**530.4**	**36.3**	**5.3**	**938.7**	**42.0**	**5.9**
America	422.9	28.9	5.9	619.1	27.7	3.9
Europe	40.9	2.8	5.0	233.8	10.5	19.0
South Africa	21.6	1.5	41.6	22.4	1.0	0.4
Asia	3.2	0.2	-14.5	0.0	0.0	
Oceania	41.8	2.9	1.5	63.4	2.8	4.2
Developing countries and territories	**930.7**	**63.7**	**9.0**	**1164.1**	**52.1**	**2.3**
America	299.2	20.5	9.5	582.1	26.0	6.9
Africa	66.0	4.5	11.9	50.6	2.3	-2.6
Asia	403.0	27.6	6.6	355.7	15.9	-1.2
Europe	1.3	0.1		2.7	0.1	7.2
Oceania	161.2	11.0	15.1	173.1	7.7	0.7
Countries in Eastern Europe	**0.0**	**0.0**		**0.0**	**0.0**	
Socialist countries of Asia	**0.0**	**0.0**		**132.2**	**5.9**	

Table 37
Largest copper ore and concentrates exporting countries
(% of world total)

1980-1982		1990-1992	
Philippines	20.0	Chile	20.4
Canada	18.6	Canada	16.0
Pap. New Guinea	11.0	United States	11.7
United States	10.3	Indonesia	9.7
Chile	10.0	Portugal	7.8
Mexico	8.1	Pap. New Guinea	7.7
Indonesia	4.6	Mongolia	5.9
Australia	2.9	Philippines	4.6
Zaire	2.4	Mexico	3.5
Malaysia	2.0	Australia	2.8
Total	89.9	**Total**	90.2

Source: UNCTAD secretariat.

Table 38
Imports of copper ore and concentrates by regions
(thousand tons and %)

	1980-1982	Share (% of world)	Growth rate since 1970-72 (% pa)	1990-1992	Share (% of world)	Growth rate since 1980-82 (% pa)
WORLD	**1466.5**	**100.0**	**7.3**	**2014.0**	**100.0**	**3.2**
Developed market-economy countries	**1230.6**	**83.9**	**5.7**	**1494.0**	**74.2**	**2.0**
America	70.2	4.8	5.7	185.6	9.2	10.2
Europe	255.2	17.4	4.6	358.6	17.8	3.5
South Africa	0.0	0.0		0.0	0.0	
Asia	901.9	61.5	6.2	949.7	47.2	0.5
Oceania	3.4	0.2		0.0	0.0	
Developing countries and territories	**152.3**	**10.4**	**28.3**	**327.4**	**16.3**	**8.0**
America	1.4	0.1	26.2	108.2	5.4	54.8
Africa	1.0	0.1	3.6	16.2	0.8	32.1
Asia	144.2	9.8	37.9	203.0	10.1	3.5
Europe	5.8	0.4	-0.3	0.0	0.0	
Countries in Eastern Europe	**48.6**	**3.3**	**18.8**	**99.4**	**4.9**	**7.4**
Socialist countries of Asia	**35.0**	**2.4**	**39.7**	**93.2**	**4.6**	**10.3**

Table 39
Largest copper ore and concentrates importing countries
(% of world total)

1980-1982		1990-1992	
Japan	61.5	Japan	47.2
Germany	9.4	Germany	7.8
Korea, Republic of	6.7	United States	5.4
United States	3.8	Spain	5.4
Spain	3.2	Brazil	5.4
USSR	2.6	Philippines	5.3
Taiwan, Pr. China	2.5	USSR/CIS	4.8
Sweden	1.7	Korea, Republic of	4.7
China	1.6	China	4.4
Norway	1.4	Canada	3.8
Total	94.5	**Total**	94.1

Source: UNCTAD secretariat.

Table 40
Bilateral copper ore trade flows, 1980-1982
(ktpy Cu content unless otherwise specified)

Exporters	Importers										Specified countries/ total imports (%)	Total exports
	Japan	Germany	Korea, Rep	United States	Spain	USSR	Taiwan, Prov China	Sweden	China	Norway		
Philippines	214.2		37.4	12.6		7.1	13.1		7.4		99.9	292.1
Canada	205.8	5.4	17.2	7.9	3.0		5.3				90.0	271.9
Papua New Guinea	80.1	55.6	1.7		13.8		2.7		5.4		98.7	161.2
United States	114.3	5.5	2.4		0.1	20.4	8.4	0.3	3.0	2.0	97.2	160.8
Chile	62.0	3.7	14.2	4.5	8.3		5.7	4.1			70.1	146.4
Mexico	21.5	27.1	9.8	21.1	11.5			6.7			82.9	117.9
Indonesia	45.4	10.1	3.9								88.8	66.9
Australia	37.4	1.6	2.6	0.6	0.1			1.1			96.6	44.8
Zaire	26.1										74.3	35.1
Malaysia	31.9										92.4	34.5
Above countries/ total imports (%)	93.0	78.7	90.4	84.5	77.5	73.7	97.6	48.9	66.4	9.3		
Total imports	901.9	138.5	98.7	55.4	47.5	37.4	36.1	25.0	23.7	21.1		

Source: UNCTAD secretariat.

Table 41
Bilateral copper ore trade flows, 1990-1992
(ktpy Cu content unless otherwise specified)

Exporters	Importers										Specified countries/ total imports (%)	Total exports
	Japan	Germany	United States	Spain	Brazil	Philippines	USSR/CIS	Korea, Rep	China	Canada		
Chile	129.6	38.3	0.4	37.3	62.7	26.4		24.1	11.4	1.0	72.5	456.8
Canada	244.1		4.5	18.4	4.7	23.5		12.2	4.8		87.3	357.5
United States	93.0	4.1		1.3	16.4	14.2	2.7	5.6	15.9	19.2	65.9	261.6
Indonesia	103.7	9.4	20.7	3.0	1.6	12.2	16.8	10.9	6.0	10.1	89.8	216.4
Portugal	26.3	44.1	4.7	28.6			12.5	0.1	10.0	13.8	80.1	174.9
Papua New Guinea	74.2	32.7				24.4		19.2			86.9	173.1
Mongolia	6.3						60.0		3.2		52.5	132.2
Philippines	101.1		10.7				1.5	4.8	3.8		97.6	125.0
Mexico	18.2		43.9	2.3	2.9	2.5		2.5	2.5		95.7	78.2
Australia	47.3	2.1	4.3			4.0		1.0	5.2	4.5	97.5	70.2
Above countries/ total imports (%)	88.9	83.7	81.5	83.5	81.7	100.0	97.3	85.5	70.5	63.7		
Total imports	949.7	156.1	109.4	109.0	108.0	107.2	96.2	94.0	89.2	76.3		

Source: UNCTAD secretariat.

Table 42
Exports of unrefined copper by regions
(thousand tons and %)

	1980-1982	Share (% of world)	Growth rate since 1970-72 (% pa)	1990-1992	Share (% of world)	Growth rate since 1980-82 (% pa)
WORLD	**749.2**	**100.0**	**0.2**	**576.7**	**100.0**	**-2.6**
Developed market-economy countries	**128.3**	**17.1**	**4.6**	**126.8**	**22.0**	**-0.1**
America	5.0	0.7	-9.6	14.8	2.6	11.5
Europe	68.5	9.1	8.1	61.7	10.7	-1.0
South Africa	38.1	5.1	2.4	24.4	4.2	-4.3
Asia	2.0	0.3		19.7	3.4	25.7
Oceania	14.7	2.0	8.2	6.2	1.1	-8.3
Developing countries and territories	**619.7**	**82.7**	**-0.5**	**443.8**	**76.9**	**-3.3**
America	263.9	35.2	-1.7	275.6	47.8	0.4
Africa	354.8	47.4	0.6	164.6	28.5	-7.4
Asia	1.0	0.1	-14.1	3.6	0.6	13.7
Europe	0.0	0.0		0.0	0.0	
Countries in Eastern Europe	**1.2**	**0.2**	**0.9**	**4.7**	**0.8**	**14.9**
Socialist countries of Asia	**0.0**	**0.0**		**1.5**	**0.3**	

Table 43
Largest unrefined copper exporting countries
(% of world total)

1980-1982		1990-1992	
Zaire	38.9	Zaire	22.9
Chile	23.0	Chile	18.5
Peru	11.3	Peru	16.3
Namibia	5.5	Mexico	13.0
South Africa	5.1	Namibia	5.7
Zimbabwe	2.8	Finland	5.1
Germany	2.8	South Africa	4.2
Australia	2.0	Japan	3.4
Finland	1.8	Canada	2.6
Sweden	1.7	Spain	2.3
Total	94.8	**Total**	93.9

Source: UNCTAD secretariat.